YOUTH CRIMINAL NETWORKS: RESOURCES IN CRIMINAL ACHIEVEMENT

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ABSTRACT

A successful criminal career is largely determined by the ability to earn money from crime and the ability to avoid arrest. The extant literature on criminal achievement suggests that offenders with more extensive criminal networks earn more money from crime. However, the impact of offenders' networks on arrest avoidance is not as clear, especially for young offenders. Using guidance from social capital theory, this study examines the impact of criminal networks on both criminal earnings and odds of arrest in a sample of youth involved in cannabis cultivation. Controlling for various background and cultivation related factors, multivariate results indicate that different network characteristics are beneficial to earnings compared to arrest avoidance. It was also found that gang members managed to achieve the greatest earnings while avoiding arrest. Results underline the importance of networks on criminal achievement in youth and implications are discussed in terms of criminal career and desistance research.

Keywords: Networks; co-offending; social capital; criminal achievement; young offenders

Subject Terms: Criminal behaviour; social networks; drug markets; cannabis cultivation

DEDICATION

To my mother. Your strength, generosity and unconditional love is extraordinary. You are not only my mother, but also my best friend. Stay strong and "if you think you can – you can".

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1: INTRODUCTION

Social relationships are a key concern for researchers who study adolescent delinquency (e.g., Haynie, 2002; Warr, 2002; Matsueda & Anderson, 1988; Elliott et al., 1989). The system and structure of these social relationships defines a social network. These structures consist of relationships that variably connect individuals as a function of their prior contacts and exchanges (Burt, 2005). Research suggests that the networks in which youth are embedded in provide them with the skills necessary to commit offences (McCarthy & Hagan, 1995; Hagan & McCarthy, 1998), increase the frequency of offending (McCarthy & Hagan, 1995), provide more opportunities to offend (Warr, 1996; McCarthy, 1996) and impact whether youth specialize in one form of delinquency or if they commit a variety of offences (McCarthy, 1996; Klein & Maxson, 2006; Blumstein et al., 1986; Sharp et al., 2006) – all factors that are related to differential success in crime. It is the role of youth criminal networks and its impact on criminal achievement that is the core of this thesis.

Criminal achievement is defined as an offender's relative success in criminal activities and is traditionally determined by illegal earnings (McCarthy & Hagan, 2001; Morselli & Tremblay, 2004, Morselli et al., 2006), prestige (Matsueda et al., 1992) and less commonly, cost avoidance (Kazemian & LeBlanc, 2007). Factors identified as important to criminal achievement can be useful in determining why offenders vary in their ability to get ahead in crime, which can have implications in terms of persistence in and desistence from future offending. Despite the abundance of research surrounding

youth and their social relationships, the effects of youth criminal networks in attaining criminal achievement remains elusive.

Criminal achievement researchers have recognized the importance of networks in success in crime and have shown that offenders who know more successful offenders (Tremblay & Morselli, 2000), use their networks more efficiently (Morselli & Tremblay, 2004) and have mentors in their networks (Morselli et al., 2006) earned more money from crime. While these studies give insight into the beneficial aspects of networks on illegal earnings, the samples in these studies were of incarcerated adult males.

There is also indication that networks are beneficial for young offenders. Several studies examined a sample of street youth and determined that networks provided tutelage relationships that facilitate the opportunity for youth to acquire skills in the criminal world (McCarthy & Hagan, 1995) and was a significant predictor of frequency of drug selling (McCarthy, 1996). Further, the willingness to cooperate contributed positively to criminal earnings (McCarthy & Hagan, 2001). These studies looked at a youthful sample and suggested that networks can be advantageous to criminal achievement. However, the sample consisted of youth who have left home and school and lived on the streets and is therefore difficult to determine if the findings of these interesting studies would be applicable to all youth.

These studies offer an important glimpse into the nature of networks and criminal achievement and suggest that networks are beneficial to an offender's illegal earnings. Yet criminal achievement is not just about making money, it is also about cost avoidance, broadly defined as the ability to avoid contact with the criminal justice system (Adler, 1993; Kazemian and Leblanc, 2007; McCarthy and Hagan, 2001; VanNostrand and Tewksbury, 1999). The research surrounding networks and risks however, are both scant and contradictory. On one hand, some offenders increase their network size to shield key players from arrest (Baker & Faulkner, 1993; Krebs, 2002; Dorn et al., 1998).

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On the other hand, the literature on group size suggests that limiting the number the people who know about one's illegal activities is a key cost avoidance strategy for many offenders (Reuter, 1983; 1985; Adler, 1993; Desroches, 2005). It is also the main premise behind a set of studies that tested the so-called "group hazard hypothesis" (Erickson, 1971; 1973; Hindelang, 1976; Feyerherm, 1980; Morash, 1984; Brownfield et al., 2001).

Lin's network theory of social capital aids in reconciling the contradictory findings on the impact of criminal networks on criminal success. Social capital is broadly defined as the use of social connections and relations as resources in achieving objectives and has been conceptualized as, "resources embedded in social networks accessed and used by actors for action" (Lin, 2001, p. 25). Lin's theory explicitly explores how social structure enhances the outcome of investing in social resources and highlights how individuals access and use the contacts in their social network to acquire resources (instrumental actions) or to preserve resources (expressive actions). This distinction is especially useful when assessing criminal achievement as returns from instrumental actions can include illegal earnings and returns from expressive actions can include cost avoidance. Moreover, according to Lin (1999), instrumental actions and expressive actions reinforce one another, but the factors associated with their returns may differ. Closed networks reinforce the preservation of resources because it increases solidarity and trust whereas sparse networks are more likely to aid in the acquisition of resources.

By using a self-report delinquency survey that was completed by 1166 adolescents attending four secondary schools in a rural region in Quebec, Canada it was discovered that 175 adolescents reported having participated in cannabis cultivation (15% prevalence rate). This thesis focuses on this sample of youth who were involved with cannabis cultivation to answer three sets of research questions: 1) What factors are related to illegal earnings? What is the influence of criminal network dynamics on

instrumental gains? 2) What factors are most relevant to cost avoidance? Are the same network measures related to instrumental gains as they are to expressive gains? 3) What are the factors most associated with the most successful participants? What are the trade-offs between maximizing illegal earnings and minimizing cost avoidance?

Cannabis cultivation presents an ideal platform to look at the impact of criminal networks and achievement for several of reasons. First, domestic marijuana cultivation has experienced extraordinary growth in industrialized nations including Canada (Bouchard, 2007; Malm & Tita, 2006), the United States (Harrison et al., 2007; Weisheit, 1991) and New Zealand (Wilkins et al., 2002). For example, Bouchard (2007) estimates that the marijuana cultivation industry in Quebec has grown to such an extent that it is self-sufficient and rivals the marijuana dealing trade. The presence of this expanding industry may offer diverse roles for youth to participate in cannabis cultivation. Starting a marijuana cultivation site can be relatively simple and inexpensive (Weisheit, 1992; Morrison, 1997), easy enough for an adolescent to maintain a small outdoor site alone or with a few peers. Indoor sites, especially large ones, require more skills, equipment, startup capital, and a more extensive division of labour (Bouchard, 2008; Weisheit, 1992; Wilkins & Casswell, 2003; Potter, 2006), which offers the prospect of adults and youths to work together.

Second, previous studies suggest that cannabis growers are a heterogeneous group: some participate for the monetary rewards while others participate for intangible ones (Weisheit, 1991; Hafley & Tewksbury, 1996; Potter, 2006). This disparity in motivation for participating in cultivation provides an interesting sample when assessing differential earnings. The potential earnings from cannabis cultivation are vast. For personal use growers, monetary earnings are secondary, whereas cultivation can be a lucrative endeavour providing commercial growers thousands of dollars each harvest.

Third, police forces have recognized the consequences of this growing industry and have invested considerable resources to eradicate the problem (Plecas et al, 2005; Malm & Tita, 2006; Wilkins & Casswell, 2003). It is thus important to look at the impact of increased law enforcement initiatives and its effects on juveniles. Further, although a few studies have examined the macro-level risks of detection for broadly defined categories of offenders (Bouchard, 2007; Wilkins et al., 2002), differences in risks for individuals have yet to be investigated.

Lastly, the size of co-offending groups involved in cannabis cultivation should be larger than what is usually found for more straightforward offenses. Maintaining a cannabis cultivation site involves numerous tasks often performed by different offenders, such as installing equipment, plant maintenance, harvesting, and manicuring. Hence, Bouchard (2007) found that the average size of offending groups per cultivation site ranged from a minimum of three to more than a dozen individuals involved in larger sites. Studying variations in co-offending dynamics and achievement is, therefore, especially meaningful for cannabis cultivation. Thus, the heightened police attention, the diverse roles in which adolescents can occupy, the varied earning potential and the social nature of cannabis cultivation presents an interesting opportunity to explore the impact of different criminal network dynamics on criminal achievement.

2: THE DEVELOPMENT OF SOCIAL CAPITAL

Social capital is an increasingly popular sociological concept that has transcended into the fields of political science, organizational behaviour and economics (Portes, 1998). Its use in the criminological field, however, is not very widespread. Social capital can be best understood as resources embedded in one's social networks which can be accessed or mobilized through ties in the networks (Lin 2001). The distinction between networks and social capital is important to highlight. According to Lin (2005) social capital is contingent on social networks, but the two should not be considered as equivalent. Without networks, it would be impossible for individuals to access and use the resources embedded within them. However, it is the variations within networks, or the network features, that determine social capital (Lin, 2005).

Social capital has several important aspects that should be underscored. First, it is a "social asset by virtue of actors' connections and access to resources in the network or group of which they are members" (Lin, 2001, p.19). Second, it represents resources in social relationships but the access and use of the resources reside with the individual. Third, the individual must be cognitively aware of the presence of the resources in his/her network and make a choice to mobilize them. Social capital is therefore, purposive action taken by an individual to invest in and use the resources that exist within his/her network.

The origins of social capital can be traced from Karl Marx's notion of capital. Marx observed that capital could emerge from the relationship and exchanges between the bourgeoisie and labourers to create profit (Lin, 2001). Contemporary social capital

theory however, is often attributed to French philosopher and sociologist Pierre Bourdieu (Portes, 1998). While a number of scholars have looked at social capital in terms of group performance (e.g. Putnam, 1995; Fukuyama, 1995), Bourdieu pioneered the individual perspective on social capital, which is the focus of this thesis, and recognized that social networks could serve as a valuable tool to offset inequalities of social class. Two points are notable in Bourdieu's work: He proposed that social capital is not naturally occurring and requires deliberate investment in building and maintaining relationships within a person's social network (see Bourdieu, 1985). Further, he suggested that social capital consists of two elements: the social relationship itself and the amount and quality of those resources (Portes, 1998). Regrettably, Bourdieu did not fully develop his theoretical perspective on social capital but did pave the way for other researchers to conceptually develop and test its notions (Schuller et al., 2000).

Since Bourdieu, many scholars have contributed to the individual perspective of social capital (e.g. Burt, 1992; Lin, 2001; Coleman, 1988; Portes, 1998). This thesis focuses on two main contributors, Ronald Burt and Nan Lin, who not only recognized that social capital is an asset that is captured through an individual's connections and access to resources in the network or group in which he/she is a member, but also drew attention to the structure within the networks that enhance the returns of social capital.

In their review of social capital, Adler and Kwon (2002) proposed that different researchers emphasize different *views* of social capital and referred to the two main views as bridging and bonding social capital. Bridging views focus on how individuals can use social capital to acquire or access resources whereas bonding views centre on resources within groups to foster beneficial outcomes for the collective and individuals within the collective. According to Portes (1998), there are three main functions of social capital: 1) "as a source of social control, 2) as a source of family support and 3) as a

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source of benefits through extrafamilial networks" (p.9). Bonding social capital emphasizes the first two whereas bridging social capital focuses on the third. Depending on the intended function of social capital, different network structures are more favourable to facilitate its returns. Smaller closed networks are expected to protect and control resources (bonding view) whereas larger sparse networks are expected to increase access to resources (bridging view). This distinction is especially useful for the purposes of this thesis because it can also expand to criminal ambitions of accessing resources such as money and protecting resources, like maintaining freedom.

Burt (1992) largely focused on bridging social capital and the role of sparse networks in the acquisition of resources but also recognized the value of bonding social capital and benefits of closed networks in preserving resources. Two decades after Mark Granovetter (1973; 1974) proposed the strength of weak ties argument, which recognized that resources that lay outside of one's immediate circle can be an important source of information[1]; Burt extended this idea and developed his concept of structural holes. While Granovetter did not specifically use the term social capital, Burt, in developing his structural holes theory, did. Burt is perhaps the most prominent researcher to bridge the gap between social capital and networks (Schuller et al., 2000). The focus for Burt is the broker position, which places the actor in a position to connect individuals who would otherwise be unconnected, what he refers to as structural holes (Burt, 1992). Structural holes are gaps between groups, "separating nonredundant sources of information" which can lead individuals to new knowledge and resources and serves as an advantage for competitive action and facilitates individual mobility whereas

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[1]According to Granovetter (1973), weak ties as opposed to strong ties, where actors know one another well, weak ties are those that bridge members from different groups, who would otherwise not be connected (Granovetter, 1973). Weak ties allow individuals to reach populations that are not accessible through strong ties and important for creating opportunities for upward mobility (Granovetter, 1974). As opposed to preserving already strong ties, establishing and maintaining weak ties would result in an individual's network being larger and sparser.

individuals who are closely connected are likely to supply redundant information (Burt, 2005, p.16).

Despite focusing on the advantages of sparse, open networks, Burt (2005) recognized that closed dense networks have advantages and closure can be combined with brokerage. James Coleman is perhaps the most well known researcher who emphasized the importance of dense, closed networks in facilitating beneficial effects for its members. Closed, dense networks produce norms or values that can inhibit malfeasance among its members and promote actions that are in the best interests of the collective group[2]. In tying the benefits of both large sparse networks and closed dense networks, Burt (2005) stated, "trust is likely to be more critical where brokerage is more valuable" (p. 94). He further asserted, "Closure provides a reputation mechanism associated with happy and safe, while brokerage provides a vision mechanism associated with achievement and rewards" (p. 94, p.127). Burt described that returns are highest among groups that achieve a balance between large sparse networks and closed dense networks. He identified these groups as "structurally autonomous" groups that consist of individuals who are strongly connected to one another but have "bridge relations beyond the group", thereby achieving the trust and safety of closure and the opportunities of brokerage (p.140-141). Burt's assertion that both closed dense networks and large sparse networks are needed and that some groups are able to strike a balance of both is especially valuable: While brokerage positions through social network analysis is not specifically examined, this thesis explores how networks different

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[2]Coleman's contribution to social capital highlights the importance of social capital in the creation of human capital (Coleman, 1988). Human capital are skills and knowledge acquired by a person (see Becker, 1964). Coleman (1988; Schuller et al., 2000) linked parents and their children and predominately looks at educational attainment as his measure of human capital to contend with social inequality.

dynamics impact risks of arrests and earnings attainment, it also explores whether

certain network characteristics aid in achieving both.

2.1 Lin's network theory of social capital

Lin explicitly tackled the tension between large sparse networks and closed

dense networks with his network based theory of social capital. Lin (2001) identified

three stages of action associated with social capital for individuals: 1) investment in

social capital, 2) the mobilization of social capital, and 3) the returns of social capital. He

also distinguished bridging and bonding social capital by highlighting that there are two

main reasons why individuals use the contacts in their social network: instrumental

actions, (to acquire resources such as wealth, power and prestige) or expressive actions

(to preserve resources such as cohesion, well-being, or freedom)[3]. According to Lin

(1999), instrumental actions and expressive actions reinforce one another, but the

factors associated with their returns may differ. Lin merged the works of Coleman,

Granovetter, Burt and others by recognizing that closed networks with homophilious ties

(contacts with similar characteristics and resources) reinforce the preservation of

resources because it increases solidarity and trust whereas large sparse networks with

heterophilious interactions (contacts with dissimilar characteristics and resources) are

more likely to aid in the acquisition of resources. It is these defining features, suggested

Lin (2005), which may be fundamental in understanding the utility of social capital, both

instrumental and expressive.

Networks are necessary for individuals to capture the embedded resources

within them, but it is variations within networks that can increase or decrease social

capital. Individuals differ in the way they structure and access their networks and it is the

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[3] Instrumental actions can also be considered a bridging view of social capital and expressive
 actions can be considered a bonding view of social capital.

structure of networks that opportunities emerge because of the resources embedded in them. Lin (2001) identified three exogenous factors that impact the returns to social capital 1. Structural positions, the actor's position within his/her network 2. Network locations, which include features like closure, openness 3. Purposes of action (instrumental or expressive motivations) (Lin, 2005). Lin emphasized that networks and social capital are not one in the same. Hence Lin (2005) argued that, concepts such as bridges, strength of ties, structural holes, size of networks, density or openness of networks, are all important to testing social capital.

Lin's emphasis on network structure and the distinction between instrumental and expressive actions that suggest that the size and composition of criminal networks that benefit criminal earnings may not be the same as those required for optimal cost avoidance. For example, a large, sparse and heterogeneous network may foster opportunity and monetary success but be more risky in terms of arrest. Thus by looking at the impact of different criminal network dynamics on criminal achievement, which will be measured in two different ways, one reminiscent of returns in instrumental actions and one reminiscent of returns in expressive actions, it can be determined which network dynamics are beneficial to each type of action.

2.2 Measures of social capital

The measurement of social capital can be both collective (macro-level) and individual (micro-level). On the macro level, it is measured in terms of trust, norms and social cohesion and on the micro-level, it is usually measured as a collection of resources owned and accessed by an individual (Van der Gaag & Snijiders, 2004). The distinctions between instrumental and expressive actions have been recognized but each action is generally measured separately. For example, organizations are characterized as serving either instrumental goals (unions, political parties) or expressive goals (sports clubs, religious organizations, neighbourhood organizations) (e.g. Bekkers et al., 2007; Gidengel et al., 2003; McMiller, 2000). Son and Lin (2008) referred to expressive civic action as the preservation of collective goods in a community and instrumental civic actions as mobilization to improve the status quo.

As action targeted towards the acquisition of resources, instrumental actions have been largely explored in the labour market. Social capital has been shown to be extremely beneficial in job searches (Lin et al., 1981; Granovetter, 1985; Flapman & Box, 2001) and among various market producers, individuals with greater structural holes made more profit (Burt, 1992). Similarly, managers who had more nonredundant contacts in their network get promoted faster than their peers (Burt, 1992). Employees with more sparse networks were also evaluated more favourably by their supervisors, enabling them to achieve better job performance (Volker & Flap, 2004).

Expressive returns of social capital have been measured mainly through trust, support (Lai & Sui, 2006; Son & Lin, 2008) and social control in the form of discouraging malfeasance (e.g. Colvin et al.2002; Wright & Fitzpatrick, 2006). Colvin et al. (2002) examined both instrumental and expressive social support and argue that both can be used to prevent an individual's participation in crime by reducing strain. Wright and Fitzpatrick (2006) conceptualized expressive returns as physical and mental well being expecting that it would reduce the incidence of self reported violence among a sample of youth. Factors such as self esteem and psychological health were considered expressive returns among urban Shanghai residents (Lai & Sui, 2006).

In criminology, social capital has also been looked at both instrumentally and expressively, but often not been identified in such terms. Expressive actions have been explored on the macro-level and conceptualized as a form of social control to deter misconduct. Because the focus of this thesis is on the micro level, review of the literature on the macro application of social capital is brief. Using community and neighbourhood rates Friedman and colleagues (2007) looked at social capital as a mechanism for trust and consensus in neighbourhoods to defend the safety and health of its members. Social capital has been shown to increase collective efficacy (Kubrin & Weitzer, 2003), combat social disorganization (Ferguson & Mindel, 2007), reduce fear of crime (Ferguson & Mindel, 2007), and lower homicide rates (Rosenfeld et al., 2001). In examining crime over the life course, Sampson and Laub (1993) linked Coleman's notion of social capital to social control theory[4] as a way to approach restraining criminal propensity. Browning et al. (2004), however, found that social capital may contribute to

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[4] Social control theory posits that crime and deviance are more likely if an individual's bond to conventional society is weak or broken (see Hirschi, 2002).

collective efficacy but can also provide individual offenders with negative social capital, which may diminish the effects of collective conventional social capital.

On the individual level, the impact of social capital has been applied to instrumental actions, usually in the forms of illegal earnings. This body of research can be identified as criminal achievement literature and will be discussed extensively below.

2.3   Social capital and criminal achievement

Criminal achievement is the degree of success throughout one's criminal career and is traditionally determined by criminal earnings (McCarthy & Hagan, 2001; Morselli & Tremblay, 2004, Morselli et al., 2006), prestige (Matsueda et al., 1992) and less commonly, cost avoidance (Kazemian & LeBlanc, 2007). Criminal achievement researchers have recognized the important role of co-offenders in success in crime. First, they argued that co-offenders should be considered as resources or social capital that can be used to get ahead in crime (McCarthy & Hagan, 2001). Second, researchers recognized that not all offenders are equally capable at developing and using this resource, and they examined whether variations in social capital were related to variations in criminal achievement.

This thesis examines the role of networks in criminal achievement and draws on several distinct yet relevant streams of literature that have touched on the social element of success in crime. Guidance from both network and co-offending literature are used extensively and as such, the nuanced distinction between an offender's network and his/her co-offenders is one that warrants attention. Unlike some other crimes (e.g. predatory crimes), the line between co-offending and networks in illegal drug markets is less discernable. Warr (1996; 2002) differentiates offending groups and networks by stating that offending groups are groups that actually commit crimes together but

accomplice networks are the pool of potential co-offenders available to the offender. However, market offences involve "consensual exchanges between customers, producers and sellers", suggesting that an offender's broader criminal network is extremely important to success (Morselli & Tremblay, 2004, p. 786). Because of this, success in drug markets are based on transactions and do not require direct participation of all offenders (Morselli & Temblay, 2004). In their study, Morselli and Tremblay (2004) advanced this complexity and broadly defined co-offending as "all individuals who are instrumental in crime activities" (p.776). Guidance from both network and group literature is valuable for the purposes of this thesis and the distinction between an offender's direct co-offending group and his/her larger criminal network will be assessed independently.

2.3.1 Networks, groups and instrumental returns

Several studies have found that networks play a beneficial role in an offender's instrumental returns. Tillman and Indergaard (1999) found that white-collar criminals who were in brokerage positions used their positions to defraud the health insurance industry. Guided by Burt's structural holes theory, Morselli and Tremblay (2004) surveyed a Quebec inmate population about their network of contacts and monthly income from criminal activities prior to incarceration. They found that offenders with greater amounts of nonredundant contacts in their network had more opportunities and therefore led to greater criminal earnings. Tremblay and Morselli (2000) reanalyzed an inmate survey conducted by the RAND corporation and discovered that high earners were more likely than low earners to know successful offenders who have never been incarcerated. The authors concluded that high earners benefited from a large and useful network. Despite these important findings, the samples in these studies are of incarcerated male

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offenders and it is unclear whether such results would be consistent with a sample of youth.

A set of studies conducted by McCarthy and Hagan among a sample of homeless youth in Toronto and Vancouver suggested that criminal networks can help with getting into crime, increase the frequency of offending and facilitate greater criminal earnings. McCarthy and Hagan (1995) investigated the impact of social capital on theft, prostitution and drug selling and found that criminal embeddedness, measured by the number of criminal friends before and after arriving on the streets and tutelage, determined by receiving assistance from friends, increased participation in theft and drug selling. McCarthy (1996) similarly found that the frequency of drug selling and theft increased with the number of deviant associations. McCarthy and Hagan (2001) explored the effects of social capital on criminal earnings. Social capital was similarly measured by the number of friends involved in drug selling while living at home and while living on the street and exposure to tutelage in drug selling. The researchers found that offenders who had a willingness to work with others (collaboration), thereby using their networks as social capital, earned more money. Despite shedding light on youth criminal networks and criminal achievement, the authors recognized that compared to adolescents in high school, homeless youth are vastly different. They are economically marginalized, have more exposure to criminal contacts and experience little social control (McCarthy & Hagan, 1995). Therefore, the beneficial impact of criminal networks on instrumental returns in a sample of high school adolescents should be similar but remains to be tested.

A third set of studies concern the more direct co-offending group as opposed to the larger criminal network. While there are a small number of studies that look at group size and illegal earnings, there is some indication that there is a positive relationship. Fagan (1992) studied 500 crack dealers in New York and found that on average, sellers

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who worked in groups had greater incomes than those who worked alone. Similarly, Reuter et al. (1990) found that among drug dealers working in the District of Columbia area in the mid-1980s, dealers who sold drugs for others made more money than those who worked on their own. These studies however do not specify the exact size of the co-offending groups and are based on a predominately inner city adult male sample. The beneficial effects of working in groups on illegal earnings may differ with a sample of youth and can depend on a variety of factors such as who they work with and how many others they work with, which will be discussed in further details later.

2.3.2 Networks, groups and expressive returns

Although research has indicated that criminal networks can be valuable to illegal earnings, criminal achievement is also about cost avoidance. The role of networks in cost avoidance however is not as clear. On one hand, size can insulate certain members in the network from risk but on the other hand, groups of larger sizes can attract attention from law enforcement.

Offenders in large networks may have the necessary resources to evade law enforcement. For example, additional accomplices can be beneficial in terms of an increased division of labour where some members can be used as lookouts or pooled financial resources can be invested in other security measures. Some offenders use their criminal network to insulate key players from detection. Analyzing the network structure of a price-fixing conspiracy in the electrical industry, Baker and Faulkner (1993) found that key players purposely decentralized and decreased their network efficiency to insulate themselves from arrest. Similarly, Krebs (2002) mapped the networks of the September 11th terrorists and established that one of their key strategies was to keep the hijackers distant from one another to increase secrecy. Among drug importers, Dorn et al. (1998) found that expendable lower-level workers were hired to distance the bosses

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from the risky aspects of the business. Williams (2001; 1998), in assessing transnational criminal networks, stated that many networks are strategically redundant to expedite network recovery if members were arrested, incarcerated or killed.

The beneficial effects of larger networks is contrasted by a second set of studies that suggest that in illegal markets, small groups are safer, easier to manage and are more efficient (Reuter, 1983; 1985; Desroches, 2005; Reuter & Hagga, 1989). These studies however focused on the immediate co-offending group as opposed to the larger criminal network of respondents for a specific venture. The consequences of illegality on size have been well established (Reuter 1983; 1985; Kopp, 2004). Reuter (1983) analyzed New York's bookmaking, numbers and loan sharking industries and proposed that the nature of illegal markets limits many firms' potential for growth. He later extended this argument to include most illegal markets, including the drug trade (Reuter, 1985; Reuter & Hagga, 1989). The notion of "keeping it small" has also been developed in the illegal drug market literature. In her ethnographic study of 65 high level dealers and smugglers in California, Adler (1993) found that as a security precaution, high level dealers and smugglers (arguably the successful ones) limited their number of co-offenders and clients. Whereas, young or lower level dealers had a "lower of standard of security", took more risks and had greater number of co-offenders and clients (p.72). Similarly, Descroches' 2005 study of 70 convicted drug traffickers, established that high level dealers maintained smaller groups because the members of the group are usually trusted and can be closely monitored. Many dealers believe that "risks increase with the number of players involved and considered it too dangerous to expand beyond their circle of trusted associates" (Desroches, 2005, p. 124). Furthermore, smaller organizations can protect themselves from informants, surveillance and infiltration by law enforcement. Bouchard (2007) looked at the risks of detection in the marijuana cultivation industry and found that the larger sites, which had more co-offenders, were

more at risk of detection than smaller ones. It is important to mention that this relationship however was technique-specific. Larger more sophisticated sites (e.g. indoor hydroponic) were at less risk of detection than smaller, less sophisticated sites (e.g. outdoor).

A number of earlier studies have found support for the group hazard hypothesis, which argued, "violating the law in groups increases the likelihood of official detection and reaction" (e.g. Erickson, 1971; 1973; Erickson & Jenson, 1976; Hindelang, 1976; Feyerherm, 1980; Morash, 1984, Brownfield et al. (2001). General explanations for the group hazard hypothesis suggest group offending results in higher frequency of offending and hence there is a greater opportunity for arrest (Erickson, 1973); juveniles who are in groups are more likely to be verbally abusive thus sheriffs are more likely to pursue official avenues (Hindelang, 1976); and adolescents who are a part of groups appear more threatening and have an increased visibility (Morash, 1984; Erickson, 1971).

In short, larger networks and groups appear beneficial to illegal earnings but the relationship between size and risks is not as clear. On one hand, larger networks can provide the resources to insulate key players from being detected. On the other hand, smaller groups appear to be safer when evading arrest. This thesis sheds light on this issue by looking at both the size of a grower's network and the size of his/her immediate co-offending group and their impact on earnings and risks of arrest.

2.3.3 Networks, composition and criminal achievement

Just as the size of networks and co-offending groups are not the same for all offenders, the composition of networks and groups also varies. Interactions between individuals are often a result of their similarities in age, interests, status, authority and proximity and is known as the homophily principle (Lin, 2001; Haynie, 2002; Sarnecki,

2001). The homophily principle has not only shown considerable support in conventional settings (e.g. Cairns and Cairns, 1995; Weerman, 2007) but in illegal contexts as well. According to Tremblay (1993), youth invest in more time and energy in establishing strong ties with their peers than searching for opportunity through weak ties. As such, many previous studies have focused on group offending in the context of exclusively juvenile groups (Carrington 2002; Erickson, 1971; 1973; Erickson & Jenson, 1977; Feyerherm, 1980, Brownfield et al., 2001; Hindelang, 1976; Sarnecki, 2001).

Offending groups however, can include a mix of adults and juveniles (Reiss, 1988). Sarnecki (2001) and Reiss and Farrington (1991) contended that similarity in both age and proximity of residence are contributing factors of group offending among youth. Nevertheless, in their self-report study on sample of 411 young London males, Reiss and Farrington (1991) found that while juveniles who were similar in age committed the majority of group offences, there was a minority of young offenders (14 %) who committed crimes with adults. From a sample of 22,000 youth in Sweden, Sarnecki (2001) concluded that the majority of drug offending pairs consisted of a partner who was at least 5.9 years older than their junior partner and they seldom lived near one another. For eager young drug dealers, it is common that they have to extend their personal contact network to include adults who can supply the drugs (Sarnecki, 2001). Because many students buy cannabis at school (Caulkins & Pacula, 2006; Harrison et al., 2007), this dynamic can be especially useful for adults who supply drugs to adolescents who can in turn sell it in school. In this case, youth have access to a market that adults do not have.

This collaboration, however often results in youth assuming low-level positions and achieving less success than their adult partners. Padilla (1992) illustrated this with a sample of drug dealers. He noted that newcomers are required to demonstrate their knowledge, establish network contacts and do menial jobs in order to become dealers.

In drug dealing partnerships, Desroches (2005) suggested that most involve co-offenders of similar age, however, some relationships involve an "older and more established dealer taking on a junior partner in a mentoring capacity" (119). He stated that it is common in this situation that the junior partner assumes more risk and earns less profit. As a person moves up the distribution chain, his/her risks are reduced; however, this progression takes time and is dependent on an offender's ability to establish a network (Desroches, 2005). Little and Steinberg (2006) found that in the 1980s high poverty rates coupled with neighbourhood social disorganization in urban centres in the US propelled adult drug dealers to recruit adolescents to sell drugs so that adult dealers could avoid punishment.

Youth - adult offending relationships however, can be beneficial if the older partner is identified as a mentor. According to Morselli and colleagues (2006), mentors provide the "security that strong ties offer, while opening doors to the efficient extensions that emerge from weak ties" (p.20). Morselli et al. (2006) found that offenders who were mentored met their mentors in late adolescence and their mentors were, on average, 11.4 years older. In this study, mentored offenders reported almost nine times greater earnings and spent fewer days incapacitated than their non mentored counterparts. In his ethnographic research of low-income male youths in three neighbourhoods in Brooklyn, Sullivan (1989) found that most successful offenders attribute their skills and success to older more experienced individuals. McCarthy (1996) looked at dimensions of differential association on the frequency of offending and found tutelage greatly improved his models of drug selling and noted the importance of transmission of skills through the role of mentors.

In sum, the effects of network or co-offending composition on criminal success are not clear. On one hand, youths who offend with other youth are likely to attract law enforcement attention due to their visibility and age. On the other hand, when working

under adults, adolescents can be placed in risky, low paying positions. Offenders who benefit from mentorship however, appear to have more criminal opportunities, higher criminal earnings and spend fewer days incarcerated. By investigating the type of network that a young grower is embedded in (predominately youth or predominately adult) and its impact on earnings and cost avoidance, it can be tested whether participants with greater homophilious ties or heterophilious ties benefit from instrumental or expressive returns.

2.4 Cannabis cultivation, adolescents and criminal achievement

Cannabis cultivation presents an ideal platform to look at the impact of criminal networks and achievement for several reasons. Domestic cannabis cultivation experienced extraordinary growth in many industrialized nations over the past 25 years (Bouchard, 2007; Malm & Tita, 2006; Potter & Dann, 2005; Weisheit, 1991; Wilkins et al., 2002). In North America, the most recent data suggests that the Canadian market is now considered self sufficient (Bouchard, 2008; Royal Canadian Mounted Police, 2004) and that the US cannabis industry is the country's largest cash crop, with over 50% of available cannabis grown domestically (Gettman, 2006).

First, the presence of this expanding industry may offer diverse roles in which youth can participate in the industry. Marijuana markets are very different from markets for other drugs (Caulkins & Pacula, 2006), and this difference starts at the production level. Production of heroin or cocaine is difficult in North American climates (or not cost efficient), and these drugs are typically imported from developing countries. Hence, for juveniles, participation in importation driven drug markets is often limited to low-level retail roles (Harrison et al., 2007; Johnson et al., 2000). The presence of a domestic cultivation industry, however, may offer plenty of opportunities for juveniles. Starting a

marijuana cultivation site can be relatively simple and inexpensive (Weisheit, 1992; Morrison, 1997), easy enough for an adolescent to maintain a small outdoor site alone or with a few peers. Indoor sites, especially large ones, require considerable skills, equipment, startup capital, and a more extensive division of labour (Bouchard, 2008; Weisheit, 1992; Wilkins & Casswell, 2003; Potter, 2006). Enter the juveniles, who represent a suitable and affordable labour force for older growers to use on indoor or larger cultivation sites. In certain contexts, juveniles may serve the same functions as youths in more traditional production countries that participate on the farms, help harvest and tend to poppy and coca fields. These dynamics provide an interesting way to look at both size and composition of criminal networks.

Second, police forces have recognized the consequences of this growing industry and have invested considerable resources to eradicate the problem (Plecas et al., 2005; Malm & Tita, 2006; Wilkins & Casswell, 2004), which provides a good opportunity to assess the impact of increased law enforcement initiatives and its consequences on juveniles. The region under study is known for having a larger than average outdoor cannabis industry, and adolescent participation in the industry has been especially been under the spotlight. To the extent that various media reports suggested that a substantial number of students missed school days during the cannabis harvest season, in October (*Journal de Montreal*, September 17, 2004). Further, the nature cultivation, unlike most predatory offences, requires several months of work before uncertain rewards are attained, prolonging the length of time a grower is at risk of being detected (a minimum of 3 to 6 months). The time frame for being considered "at risk" of being arrested is extended with cultivation, even when compared to drug dealers, whose "dealing cycles" last a few days to a few weeks (Caulkins et al., 1999).

Third, previous studies suggest that cannabis growers are quite a heterogeneous group: some participate for the monetary rewards while others participate for intangible

ones (Weisheit, 1991; Hafley & Tewksbury, 1996; Potter, 2006). This diversity provides an interesting sample of offenders to measure criminal achievement. A handful of qualitative studies have proposed typologies of adult growers based on the differential motivations for participating in the industry. For example, through interviews with 31 domestic growers and 30 law enforcement officials, Weisheit (1991; 1992) found three types of commercial cannabis growers in rural Illinois: the hustler whose primary motivation is profit and is enticed by the danger of involvement in an illegal industry; the pragmatist cultivates cannabis out of financial necessity; and the communal grower is often a cannabis user and tends to operate smaller sites in conjunction with his/her legitimate endeavors. Hafley and Tewksbury (1996) found two additional types of cannabis growers in their sample of 55 rural Kentucky growers: the young punk and the entrepreneur. The young punk is the wannabe cannabis grower who occupies low level roles because he/she does not have kinship relations or resources to support his/her own site.

Researchers in United Kingdom have also looked at grouping cannabis growers. Hough et al. (2003) looked at 37 growers in the UK and found five different motivations for growing. They found the sole-grower; the medical grower; the social grower; the social/commercial grower and the commercial grower. Most recently, with a sample of growers found through ethnography and internet message boards, Potter (2006) looked at both growers' motivations and their relationships with other growers. Potter divided his sample into financial and non-financial motivation. The not-for profit group of growers include personal use, medical and activist growers. The financially motivated group includes the small-scale grower, the one-off opportunist and the self-employed grower. Potter (2006) also classifies the large scale for profit cultivator as the corporate grower, who is fuelled by solely financial gains, is often involved in other crimes, and has the potential for violence.

Two important points are worth mentioning regarding the implications of these studies. First, although these studies provide an important glimpse into the motivations of cannabis growers, they focus on adult growers and relatively little is known about youth participation in the industry. Second, they highlight the diversity of motivation among cannabis growers. Along with the diversity of motivations, criminal achievement among commercial growers and personal growers would be relative to their aspirations.

Finally, cannabis cultivation is a social endeavour. The size of co-offending groups involved in cannabis cultivation should be larger than what is usually found for more straightforward offenses. Maintaining a cannabis cultivation site involves numerous tasks often performed by different offenders, such as installing equipment, plant maintenance, harvesting, and manicuring. Hence, Bouchard (2007) found that the average size of offending groups per cultivation site ranged from a minimum of three to more than a dozen individuals involved in larger sites. While a division of labour is useful for practical purposes, it can also be detrimental in terms of risk. Weisheit (1992) found that growers use tactics such as minimizing contact with others, reducing the number of clients, maintaining small operations to reduce the risk of being detected by police. Interestingly, nearly all of the cultivators in Weisheit's study were identified through police informants in the community.

Studying variations in co-offending dynamics and achievement is, therefore, especially meaningful for cannabis cultivation. The diverse roles in which adolescents can participate in the industry, the heightened police attention, the varied earning potential and the social nature of cannabis cultivation presents an interesting opportunity to explore the impact of different criminal network dynamics on criminal achievement.

2.5 The current study

The current study examines the impact of criminal networks on criminal achievement among a sample of youth who participate in cannabis cultivation. Lin's (2001) network theory of social capital provides guidance when looking at the relationship between criminal networks and criminal achievement because it emphasizes an offender's ability to mobilize his/her contacts into resources and suggests that the resources required for returns to instrumental actions and expressive actions may be different. When reviewing the literature relevant to the impact of networks and groups on criminal achievement, several gaps can be identified.

Consistent with Lin's theory, the extant literature on networks and criminal achievement strongly suggests that large sparse networks are beneficial to instrumental returns (Tillman & Indergaard, 1999; Morselli & Tremblay 2004; Tremblay & Morselli, 2000; McCarthy & Hagan, 2001). However, the samples used in these studies have been either on adult incarcerated males or homeless youth, two samples with very distinct characteristics. This thesis hopes to extend these findings to a sample of high school youth by looking at both network size and co-offending group size on illegal earnings.

Contrary to large sparse networks being beneficial to instrumental gains, Lin (2001) suggests that smaller dense networks are conducive to expressive returns because they facilitate trust and cohesion among their members. Although the literature on networks and instrumental returns are consistent, the results for expressive returns are not as clear. On the one hand, a number of other studies indicate that some key players may add redundancy to their networks to protect themselves from arrest (Baker & Faulkner, 1993; Dorn et al., 1998; Williams, 2001). On the other hand, drug market studies suggest that smaller groups appear to preserve the safety of its members

(Reuter, 1983; 1985; Adler, 1993; Kopp, 2004; Desroches, 2005). To contribute to this

dialogue, the size of networks and the size of direct co-offending groups on a grower's

odds of arrest will be assessed independently of each other.

Recall that according to Lin (2001), heterophilous ties are beneficial for

instrumental actions because they provide a different set of contacts whereas

homophilious ties are centred on trust and the sharing of resources and considered best

for expressive actions. The findings in terms of network type and criminal achievement

are also contentious: Youth who offend with adults can be placed in risky, low paying

positions (Padilla, 1992; Desroches, 2005; Little & Steinberg, 2006) but if the adult

assumes a mentorship position, the youth can benefit in terms of greater opportunities

and earnings (McCarthy & Hagan, 2001; McCarthy, 1996; Morselli et al., 2006). This

study explores network type by growers who are embedded in predominately adult

networks (heterophilious) and growers who are embedded in predominately youth

networks (homophilious) and their respective roles in a young grower's instrumental and

expressive returns.

This thesis turns its attention to juvenile cannabis growers, a group that has

largely been overlooked in past research. Using data from a self-report delinquency

survey completed by 1166 adolescents between 13 and 17 years old attending one of

four secondary schools in a rural region in Quebec, Canada. A total of 175 adolescents

reported having participated in marijuana cultivation (15% prevalence rate). While not

using traditional social network analysis per se, growers are distinguished by those who

are embedded in adult networks or those who are in juvenile networks, the size of each

network, gang member status and direct co-offending groups, in the hopes of

discovering which network dynamics, if any, contribute to illegal earnings and risks of

arrest, both proxies of criminal achievement. To assess the trade-offs that are

associated with attaining both instrumental and expressive returns, the most successful

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adolescents; participants who achieve the greatest earnings while being able to avoid

arrest are isolated.

3: DATA AND METHODS

In November 2006, 1262 questionnaires were distributed and administered throughout four secondary schools located in two Regional County Municipalities (RCMs) in Quebec. Both RCMs are economically dependent on agriculture and two major industrial plants. The populations of the two RCMs are 18,000 and 23,000 and have an average per capita income ($27,000) that is lower than the rest of the province ($29,000)[5]. As the schools were relatively small, one trained research assistant was able to survey all the classes in each of the schools in one day. The students' responses were completely anonymous and schools were guaranteed confidentiality.

The participation rate approached 100%; 7.6% (n=96) of the participants did not have valid questionnaires and were removed from analysis. Some examples of invalid questionnaires include forms that were blank, forms that contained extreme missing values and forms that contained the same selection for every question. Therefore, a total of 1166 participants were included in the analysis. A pre-test was conducted in one of the schools before the start of the study to improve the clarity of questions and efficiency of the instrument. Because the period for conducting the study was limited, the questions focused on the self-reporting of criminal activity instead of non-crime characteristics like family dynamics, psychological attributes or attitudes.

The questionnaire administered contained 54 multiple-choice questions on criminal activity, victimization, drug use and cannabis cultivation. The survey objective

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[5] Indicators are based on 2006 census figures from Institut de la Statistique du Quebec (http://www.stat.gouv.qc.ca)

was to investigate cannabis cultivation among the region's youth, so the last 24 questions were devoted to that particular offense (see Appendix B).

Although there are some concerns with the validity of self-report surveys, information on some key topics tackled here (e.g. illegal earnings, grower networks and substance use) are difficult to obtain with other methods. The research however, may benefit from multiple data sources, which are more valid than one single source. For example, Farrington et al. (1996) state that multiple sources can cancel out errors and combined scales can help overcome some problems with self-report data such as inaccurate recollections or concealment. Cross validation with official data could be especially useful for individuals who were arrested. Nevertheless, research on cross validation is optimistic and suggests that a great majority of youth do in fact report most their offences. A methodological review conducted by Hindelang et al. (1981) also found that the correlates between official and self-reported delinquency are essentially the same. Compared to official statistics, youth who have officially been involved with the system, self-report their delinquency at a substantial rate (Thornberry & Krohn, 2000; Huizinga & Elliott, 1986; Dunford & Elliott, 1984). For example, Thornberry and Krohn found that the correlation between official and self-reported delinquency rates for African American females and Caucasian males are .58 to.65 and are considerably higher than for African-American males (.35).

The last part of the questionnaire had three questions that were designed to be answered by every respondent, whether or not they had participated in cannabis cultivation. The first two questions asked respondents about the number of juveniles and adults they knew who were involved with cannabis cultivation. The third question asked respondents the age at which they participated in the cannabis cultivation industry for the first time. If they never participated, the survey was over for them. This third question (or another one about participation that followed) received a positive response from 194

respondents; this group was retained for further consideration. In order to be included in the final sample of growers, participants had to answer a majority of the additional cultivation-related questions, and had to offer consistent and credible answers for the rest of the questionnaire. The most common reason for excluding a participant was missing data. Respondents were systematically removed if the majority of the cultivation-related questions were not answered. A total of 19 participants were removed, making the final sample of growers 175.

Involvement in cannabis cultivation can take many forms and includes any role that one can occupy in cultivation, from maintenance to harvest. Given the right circumstances, running a small time outdoor cultivation site is simple and inexpensive enough that it can be done by most people (Weisheit, 1992), including adolescents. However, starting an indoor cannabis cultivation site requires money, a personal mode of transportation, and access to a location – all of which may be difficult for adolescents to obtain while they attend school and live with their parents. Thus for sophisticated sites, there are many different tasks involved in cultivating cannabis besides full-time maintenance of an indoor site. Some of these tasks, like harvesting, trimming the plants, or packaging only require occasional labour (Potter, 2006), which is suitable for youth involvement in the industry.

Of the total sample size, 15% (n=175) of these high school students, at one point in their life, had been involved in cannabis cultivation. This prevalence rate (15%) compares to the prevalence rates for drug dealing found in the early 1990s during the peak of the rock-cocaine era in the United States (Saner et al., 1995). Steinman's 2005 study of 39,000 high schoolers in Ohio found similarly high numbers of drug dealing: 11.9%. A Canadian study conducted by Smart et al. (1992) however, found much lower prevalence rates in a sample of high school students in Ontario, 4% for cannabis selling and 2% for selling other drugs. Indeed, the present sample is involved in cultivation at

similar rates to cannabis usage in the general population (Adlaf et al, 2005). Within the

province of Quebec this sample of highschoolers are involved at nearly fifteen times the

rate discovered for the province as a whole (Bouchard, 2007). While disconcerting, this

high prevalence rate was somewhat expected, because the region is known for its

outdoor cultivation industry. At the same time, a high prevalence of cannabis cultivation

provides opportunities for adolescents to enter an illegal industry, to make extra earnings

and encounter the criminal justice system, which is the focus of this thesis.

3.1 Measures

The aim of this thesis is to explore the impact of criminal networks on criminal

success. To test whether or not criminal networks impact criminal achievement (net of

other factors) controls were chosen and measure several theoretically driven categories

associated with determinates of criminal achievement, which includes: demographic

factors, cultivation site characteristics, and measures of intensity and frequency of

involvement. Criminal achievement is defined as earnings, arrest and detection.

3.1.1 Dependent variables

Illegal earnings

Wealth is a fundamental component of success in both legitimate and illegitimate

endeavours. Not surprisingly, many studies relating to criminal achievement have

identified success in terms of illegal earnings but typically only look at adult earners (e.g.

Tremblay & Morselli 2000; Wilson & Abrahamse, 1992; Levitt & Venkatesh, 2001;

Matsueda et al., 1992; Reuter, McCoun & Murphy, 1990; Venkatesh, 2001). Studies on

criminal achievement among adolescents have been largely limited to samples of

homeless youth (McCarthy & Hagan, 2001).This study turns its attention to illegal

earnings among high school adolescents.

Adolescents have increasingly ascended into a large share of consumer markets. Many advertisements of brand name goods solely target the youth market (Wright, 2002). Not surprisingly, more adolescents are obtaining part-time jobs and seeking larger allowances from parents (McCarthy & Hagan, 2004). For some youth however, crime presents an alluring mechanism to achieve such desires (Wright, 2002; Williams, 1989), as is the case for the majority of respondents in this study. In a separate analysis 69.3% of the respondents in this sample reported that making money was a motivator for participation in cannabis cultivation.

Past studies have utilized log transformations in the analysis of criminal earnings (Morselli & Tremblay, 2004; Fagan, 1992; McCarthy and Hagan, 2001; Uggen & Thompson, 2003), which provides detail and flexibility. Here, earnings is a seven category ordinal variable, ranging from no earnings to earning over $10,000. Participants were asked, "How much did you make from cannabis cultivation" the last time they participated. The breakdown of the variable is shown in Table 1 and univariate analysis reveals that the median earnings for the sample the last time they participated in cultivation was $101-500. Note that although the median earnings was $101-500, there is considerable variation: 14.3% earned more than $5000 the last time they participated in cultivation while 22.3% reported no earnings. These amounts are consistent with the few studies that look at the self-reported criminal income earned by youth. Freeman (1996) found that among a group of Boston youth who make money from crime, occasional offenders and weekly offenders earned $250 and $448 respectively[6]. Viscusi (1986) surveyed inner-city youth (15-24 years) from Boston, Chicago and Philadelphia and found that the average monthly illegal income was $272. Among a sample of homeless youth in Toronto and Vancouver, McCarthy and Hagan (2001) found that the

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[6] Freeman used an aggregate category of "money from crime" and did not specify what type of crimes the offenders engaged in.

average daily earnings of participants in the drug trade was $101. Considering the

participants in the present study are a high school sample, where they are in school the

majority of the day, some of their earnings are quite impressive, especially because

earning money from cultivation is slightly different than drug dealing: cultivation requires

several months of work before monetary benefits are attained.

Cost avoidance

While the extant literature on criminal achievement largely focuses on illegal

earnings, the relationship between criminal rewards and risks of crime are inherently

linked, and has been noted in earnings literature. Morselli and Tremblay (2004) state

that although punishment avoidance is not a direct proxy for crime rewards, they are

likely linked to criminal achievement as well as to an individual's capacity for crime. In

one of their models, Uggen and Thompson (2003) found that perception of risks

significantly decreased illegal earnings. Perceptions of risks can alter the decisions to

commit crime or the frequency at which crimes are committed (Uggen & Thompson,

2003; Piliavin et al., 1986). This suggests that risks and financial gain are closely related.

McCarthy and Hagan (1995; 2001) propose that criminal success can be measured

through a variety of gauges, such as financial returns or profits and detection or

apprehension avoidance. Assuming human actions are purposive and exist within the

rational choice perspective, which posits that offenders are hedonistic and weigh costs and

benefits when committing crimes (Clarke & Cornish, 1985; Tibbetts & Gibson, 2002), the

juxtaposition between illegal earnings and cost avoidance is particularly well suited for

market crimes (Cornish, 1994), such as cannabis production.

Cost avoidance can be broadly defined as the ability to avoid contact with the

criminal justice system (Adler, 1993; Kazemian & Leblanc, 2007; McCarthy & Hagan,

2001; VanNostrand & Tewksbury, 1999) and is often measured through official police

records (see Bouchard, 2007; Kazemian & Leblanc, 2007; Saner et al., 1995).Here, two

indicators of cost avoidance were used: self-reported arrest and detection. One advantage that self-report methodology has when measuring cost avoidance is that it allows comparison between offenders who come into contact with the criminal justice system and offenders who elude the system – an essential element of criminal achievement.

If a respondent was arrested one or more times for cannabis cultivation, they were coded into the "arrested" category. Some respondents were not arrested, but reported that they had participated in a cultivation site that was detected by the police. If participants were arrested or if they knew someone from the same site who was arrested for cultivation, they were coded in the "detected" category. Detection was chosen as an additional dependent variable for both pragmatic and theoretical reasons. First, arrest for cannabis cultivation is a relatively rare event, and considering the issue of detection increased the sample size and statistical power[7]. It is also important to distinguish between detection and arrest (Bouchard, 2007). Detection of a site does not necessarily result in any arrests; however, an arrest implies that the site was detected by law enforcement. Previous studies suggest that the risks of detection are far greater than the risks of arrest. Bouchard (2007) estimated that 19-37% of outdoor sites result in detection, whereas the risk of arrest for a cultivation offense is only 2-5%. In this sample, 29 out of 175 (16.6%) respondents reported having been arrested for cannabis cultivation, whereas the sample increases to 47 (26.8%) participants when those who participated in a site that was detected, whether or not they were also arrested. These arrest rates are higher than expected, and likely reflect the focused police attention on growers in this region.

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[7] Statistical power is a requirement of a good statistical test and refers the probability that a statistical test will lead to a decision to reject the null hypothesis when it is in fact false (McCall et al., 2001).

Second, it is possible that "arrested" and "detected not arrested" participants are different, the latter category having avoided most of the downfall. Results indicate that there are few differences between the 18 respondents who participated in a detected site and the 29 who were arrested themselves. This will be explored later.

3.1.2 Main independent variables: criminal networks

Four variables related to the respondents' criminal network are used—three are specific to cannabis cultivation. The first measure is the size of the participant's co-offending group the last time they participated in a cultivation site. All the participants were asked the following question: "How many persons have participated (you included) in this cultivation site, from start to finish"? The number of co-offenders was originally a seven category ordinal variable (from none [alone] to more than 15 co-offenders) that was recoded into a five category ordinal variable to ensure adequate cell counts for bivariate and multivariate analyses. Descriptives show that the median number of co-offenders is between 3 and 4, which is consistent with previous studies. Using interview data, Bouchard (2007) found that the mean number of co-offenders for a typical cannabis cultivation site is 4. Similarly, Warr (1996) and Reiss (1988) both suggested that typical offending groups have from 2 to 4 people and seem to diminish with age.

A number of studies suggest that in illegal markets, small groups are safer, easier and more efficient than larger organizations (Reuter, 1983; 1985; Desroches, 2005; Reuter & Hagga, 1989). The "group hazard hypothesis", suggests that offending in groups can hinder criminal success by increasing the likelihood of official detection and reaction (see Erickson, 1973; Erickson & Jenson, 1976; Hindelang; 1976; Feyerherm; 1980; Morash, 1984; Brownflield et al., 2001). Despite the added risks that larger co-offending groups can incur, there is some indication that size can increase illegal earnings. Fagan (1992), for example, found that drug dealers who worked in groups

earned more money than those who were lone dealers. The number of co-offenders should be positively related to both earnings and cost avoidance.

The second set of variables of interest involve the larger criminal network of respondents, as opposed to the more direct co-offending group for a specific venture. Recall that Warr (1996; 2002) differentiates offending groups and networks by stating that the former are groups that actually commit crimes together but accomplice networks are the pool of possible co-offenders available to the offender. Other researchers suggest a broader definition of co-offending to include all individuals who are important to the crime (Tremblay, 1993; Morselli & Tremblay, 2004). Here, there is a distinction between an offender's direct co-offending group and his/her larger criminal network to assess if the two concepts differentially influence criminal success. In this study, criminal network is broadly defined to include people who a respondent knows, but may never commit crimes with whereas Warr's definition of accomplice networks implies that at one point the accomplices will converge to commit crime.

All respondents were asked the following question: "Among all of the youth that you personally know (friends and acquaintances) who attend your school, how many have participated in a cannabis cultivation site in the past 12 months?" Then, a similar question was asked regarding the number of adult growers they personally know. At least two features of these questions are noteworthy. First, they are crime specific, which was important because the dependent variables, earnings, arrested and detected, are also crime specific. Second, they are age-specific, as they differentiate between youth and adults networks.

The distinction between youth and adult networks merits attention because network composition may affect criminal success. Recall that Lin (2001) suggested that homophilious ties reinforce expressive returns while heterophilious ties aid in instrumental returns. Research surrounding network composition however is

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contradictory. A number of studies suggest that when adolescents work with adults, they generally earn less and are at greater risk than their older accomplices (Little & Steinberg, 2006; Desroches, 2005). Conversely, among a cohort of incarcerated males, Morselli and colleagues (2006) found that respondents who had mentors spent fewer days incapacitated and almost nine times greater earnings than non-mentored respondents.

Initially, network size was a seven category ordinal variable (from none to more than 15 adults/juvenile known). They were re-coded two ways. First, each respondent was compared regarding the number of adult and juvenile growers they knew. Respondents who reported knowing more adults than juveniles were considered to have a predominantly adult grower network (19.4%), and vice-versa (43.4%). More than one-third (34.4%) knew the same number of juvenile and adult growers (see Table 1). Second, the variables were dichotomized, isolating respondents who knew an extensive number of juvenile growers, and those who knew an extensive number of adult growers. Results reveal 39 respondents (23.5%) knew more than 15 adults and 53 respondents (31.7%) knew more than 15 youth. The idea was to verify if the interaction of network type and large size has an independent impact on criminal achievement. Regression tree analyses (CHAID), which can be used to help identify how to recode predictor variables while minimizing the loss of information, confirmed that 15 was a suitable cutting point. An overview of the CHAID technique will be discussed in more detail later. Respondents who are embedded in adult networks should be at more risk and earn less than those who are a part of youth networks.

Table 1 Coding and description of the sample of growers (n = 175)

	% (n)
Demographics:	
Gender	33.5 (58)
(Females =1)	
Mean age	15.7 (SD .99)
Risk factors:	
Involvement in other crimes=1	57.5 (96)
(Theft, fraud, possession of firearms, sexual offences, assault and mischief =1)	
Drug dealing=1	50.3 (88)
(in last 12 months)	
Regular hard drug use=1	20.8 (33)
(Use cocaine, hallucinogens, heroin, amphetamines or other drugs at least once a week)	
Regular cannabis use=1	58.3 (95)
(Use cannabis at least once a week)	
Type of site	36.5 (57)
(Last participation, indoor =1)	
Intensity of involvement	61.1 (96)
(Owner of cultivation site = 1, hired labour=0)	
Commercial site =1	59.4 (92)
(21+ plants)	
Mean years of exp growing	1.9 (SD 1.49)
Multiple sites=1	47.4 (81)
(2+ sites)	
Network variables:	
Predominantly adult network	19.4 (31)
(greater adults than youth in network)	
Predominantly youth network	43.8 (70)
(greater youth than adults in network)	
Balanced network	34.4 (55)
(equal adults and youth)	
Large adult grower network =1	23.5 (39)
(Knowing more than 15 adults involved with cultivation)	
Large youth grower network =1	31.7 (53)
(Knowing more than 15 youth involved with cultivation)	
Median number of co-offenders	3-4
(Number of immediate co-offenders)	
Gang member=1	17.8 (30)
(Member of organized gang)	
Dependent variables:	
Median earnings	$1-500
(from cannabis cultivation)	
Arrested	16.6 (29)
(Arrested for cultivation)	
Detected	27.3 (47)
(Arrested themselves or someone from the same site arrested)	

Every respondent was asked the following question: "In the past 12 months were you involved in an organized gang?" and 30 respondents reported they were self-identified gang members. Even though group offending is commonly associated with gang membership, the two concepts should be differentiated (Carrington, 2002; Warr, 2002). For example, Carrington (2002) argued, "Gang members may commit crimes alone or in groups, and crimes committed by groups may or may not be manifestations of gang activity" (p. 278). Further, Warr (2002) stated that "gangs constitute only a small fraction of delinquent groups [and] a gang-like structure is not a prerequisite for delinquent behaviour" (p.5). Klein and Maxson (2006) looked at 2,860 gangs in 201 cities across the US and established that generally the larger the gang, the fewer the average monthly arrest per member. Using data from the Seattle Youth Study, Brownfield et al. (2001) found that status as a gang member and the visibility it provides may induce additional risks independently of co-offending patterns. In terms of earnings, Huff (1996) surveyed members and former members of youth gangs in Ohio and found that gang members earned 50% more from selling drugs and had more customers than their non gang counterparts. Levitt and Venkatesh (2000) found contrary results: independent drug dealers with no gang affiliation earned more than low-level gang members. Gang members are expected to be at greater risks of arrest but earn more money.

3.1.3 Control variables

Demographic variables

The first set of control variables includes two demographic variables, age and gender. There were 58 females and 115 males in the sample: the mean age is 15.7 years. Regarding risk, younger adult offenders have been shown to take more risks than older adults and they tend to be involved with larger groups than their older

counterparts (Morselli & Tremblay, 2004; Bouchard, 2006; Natarajan & Belanger, 1998; Reiss, 1988). It is not clear whether the same relationship can be found in a sample of juveniles only. Gender may also be related to criminal achievement. Fergusson et al. (2003) discovered that males are significantly more likely than females to be arrested for cannabis related offenses. Male offenders however, were found to be more likely to benefit from monetary opportunities than female offenders (Morselli & Tremblay, 2004). As such, males are expected to be associated greater earnings but also with greater risks.

One of the secondary schools is considerably larger than the other three with 42.9% of the participants attending that school. The RCMs are also not equal in student representation; one contained 68% of the respondents. Additional analyses reveal that neither the schools nor the RCMs were related to the dependent variables and was removed from further analysis.

Cultivation related variables

Because achievement maybe related to sources beyond the individual-level, the first set of control variables concern aspects related to the cultivation site in which the respondents participated. The context surrounding a youth's participation, such as type of site, size of site, and the intensity of his/her involvement may all have consequences on criminal success. It is therefore important to control for contextual aspects of a youth's participation to test for the impact of networks on criminal achievement.

First, the type of site in which the respondent most recently participated was controlled for, defined as either outdoor or indoor. The distinction merits attention because of its relation to risks. Outdoor sites tend to be at greater risk of detection (Bouchard 2007; Wilkins et al., 2002). In the present study, the reported rate of participation in an outdoor cultivation site was 63.5 % (Table 1). This is consistent with

expectations for youth involvement in cultivation, which should be found in the less

sophisticated, less capital-intensive outdoor sites (Bouchard, 2007; 2008). It is also not

surprising within a region dependant on agriculture and known for outdoor cultivation.

Opportunities for adolescents to start their own indoor sites are scarce. There are

however, opportunities for youth to participate as regular or occasional hired help on an

indoor site. In this case, juveniles would likely assume low-level, low-paying jobs, which

place them in hazardous positions and increase their odds of arrest. Despite its higher

detection rate, it is easier for outdoor growers to evade arrest. Unlike indoor sites,

outdoor growers can leave the plot unattended for extended periods of time, or only visit

the plots at night. Arrest data for Quebec show that only 14% of outdoor detection lead

to arrest, whereas 76-95% of detection of indoor sites lead to arrest (Bouchard, 2007). It

is expected that indoor sites to be associated with higher risks for arrest and lower

earnings.

      Participants in larger, commercial sites may be at higher risk of detection and

arrest than those who cultivate for their personal cannabis consumption (Bouchard,

2007). Consistent with previous research, sites that contained more than 20 plants were

considered "commercial sites", which suggests that some reselling of cannabis is highly

likely (Bouchard, 2007; Weisheit, 1992; Hough et al., 2003). Table 1 shows that close to

59.4% of the sample participated in a commercial site. The role of high school students

involved in commercial cultivation sites may be limited to short-term hired labour, as

opposed to full-time "owners" (which means they are accountable for the site, not

owners of the land/property), in this case, their risks may be low but so would their

earnings.

      Ownership of a cultivation site could represent a more serious involvement in the

industry than being hired help and the potential for earning money is greater for owners

than labourers. Because different roles may have differential impacts on earnings and

risks, the intensity of participation (labourers vs. owners) was also controlled for. Univariate analysis shows that 61.1% of respondents in the sample were responsible of their own cultivation site.

Criminal career research has shown that frequency of offending is generally related to higher earnings but also to higher arrest rates (although some high-rate offenders successfully evade detection) (Morselli & Tremblay, 2000). Two measures of intensity of participation were included: the number of years spent as an active grower (actual age – age of onset), and whether the respondent participated in more than one site in the past year. On one hand, the more experience a grower has, his/her skill level may increase along with his/her illegal earnings (Uggen & Thompson, 2003). On the other hand, the longer the time spent as a grower, the more opportunities to be arrested. The mean number of years of experience in the sample is 1.9 and 47.4% of the respondents participated in multiple sites. A positive relationship is expected between participation in multiple sites for both earnings and arrest.

Risk behaviours

The last set of control variables includes typical risky behaviors identified in prior research on criminal achievement: involvement in other crimes, involvement in drug dealing over the previous 12-month period, regular hard drug use, and regular cannabis use. Involvement in other crimes is a dichotomous variable that indicates whether respondents also participated in any of the following crimes: mischief, assault, theft, possession of firearms fraud, and sexual offenses. Specialization in crimes has been shown to be beneficial in criminal achievement, as it relates to criminal earnings (Tremblay & Morselli, 2000; Hagan & McCarthy, 1997; McCarthy & Hagan, 2001). As for arrest, individuals who were involved in non-drug related crimes were also more likely to be arrested for marijuana related offenses (Fergusson et al., 2003). A little more than

half the sample (57.5%) reported involvement in other crimes. This study also examined if growers were involved in drug dealing, which can attract additional attention from law enforcement and increase the likelihood of detection for participation in other offenses, such as cannabis cultivation. It is expected that drug dealing will increase both the risks of arrest the odds of making a lot of money. Half the respondents (50.3 %) in the present study reported selling drugs.

Past research on drug markets suggested that hard drug users can become unreliable and sloppy in their business dealings and are not trusted by higher-level dealers (Adler, 1993; Johnson & Natarajan, 1995; Matrix Knowledge Group, 2007). Kazemian & LeBlanc (2007) found that drug use was a significant negative correlate of differential cost avoidance in late adolescence or early adulthood. Regular hard drug use however, is a costly habit. Youth may find that participation in cultivation as a means to earn extra money to support their habit. Uggen and Thompson (1993) found that offenders had increased criminal earnings during the periods of cocaine or heroin use.

Respondents were considered as regular users of hard drug if they reported using either/or cocaine, hallucinogens, heroin, amphetamines, or other drugs at least once a week throughout the past year. Table 1 shows that a little more than 20% of the sample admitted to using hard drugs on a weekly basis. As expected, regular use of cannabis was more common with a 58.3% prevalence rate. The rates of occasional (at least once a month) hard drug (21.7%) is comparable to regular use whereas occasional cannabis use was much lower (19.6%) than regular cannabis use. These high rates are not surprising. Traditionally, drug use is extremely high among young offenders (Newburn, 1998). In a self-report survey of Canadian adolescents, Smart et al. (1992), matched a group of drug dealers with a group of non-sellers, and found that 97% of the dealers used cannabis in the last 12 months compared to only 16.3% of non drug sellers. The drug dealing sample also had a significantly higher rate of hard drug use.

Inciardi and Pottieger (1991) interviewed 254 crime-involved youths in Miami and found 87% used marijuana daily and 11% used marijuana occasionally (3+ times per week).

3.2 Analytic strategy

This thesis has three sets of research questions and uses a three-pronged analytical approach to examine the impact of criminal networks on criminal achievement among a sample of youth who participate in cannabis cultivation. The research questions are as follows:

1. What factors are related to illegal earnings? What is the influence of criminal network dynamics on instrumental gains?

2. What factors are most relevant to cost avoidance? Are the same network measures related to instrumental gains as they are to expressive gains?

3. What are the factors most associated with the most successful participants? What are the trade-offs between maximizing illegal earnings and minimizing cost avoidance?

To answer the first set of questions, nested ordinal regression models predicting earnings for cannabis cultivation was conducted in three stages, running two models at each step. The first stage examined the role of network type on earnings; the second stage considers the interaction of network type and large size; and the third stage is the best model, including only variables that were significant or close to significance in the first two stages. To investigate the profiles of respondents who had the greatest amount of instrumental returns, a classification tree model was developed using Chi-square Automatic Interaction Detector (CHAID), a technique used for criterion based segmentation and which will be discussed below.

The second set of questions was addressed through nested logistic regression models predicting arrest for cannabis cultivation and was carried out in three stages

similar to the earnings model. CHAID was also performed to investigate the profiles of respondents. The same models were used for detection.

The last set of questions was addressed by exploring the factors associated with the most successful participants. The relationship between each independent variable was tested at the bivariate level against the interaction of the two main dependent variables: youth who had the greatest instrumental returns (earned more than $5000) and the greatest expressive returns (not arrested). Profiles of successful participants were developed using CHAID. The next section provides a brief overview of the multivariate methods used in this thesis.

3.2.1 Multivariate methods

To tackle the research questions, a number of different procedures were required. The choice of methods was based on the research question and the nature of the data. Along with three multivariate methods, two bivariate methods were used, namely Pearson's Chi-square test of significance and Spearman's rho. Pearson's Chi-square is a non-parametric test that compares the observed frequencies to the expected frequencies to determine if two groups are associated with one another (McCall, 2001). Pearson's Spearman's Rho is a common measure of directional association between two ordinal variables or an ordinal and an interval level variable (McCall, 2001).

Binary Logistic Regression

Binary logistic regression is a form of regression that is used when the dependent variable is a dichotomy; independent variables can be either continuous or categorical. Logistic regression is used to predict the explained variance of the dependent variable based on the independent variables, determine the relative importance of the independent variables in terms of the dependent variable and to

understand the impact of each predictor variable net of the other variables in the model (Garson, 2009). Logistic regression applies maximum likelihood estimation after transforming the dependent into a logit variable (the natural log of the odds of the dependent occurring or not). Maximum likelihood estimation finds estimates of the model parameters that will most likely resemble the observations in the sample (Pampel, 2000). In this way, logistic regression estimates the odds of a certain event occurring, in this case the odds of arrest (yes/no) and odds of detection (yes/no). Binary logistic regression is therefore the most appropriate method to measure cost avoidance because in this study, the dependent variables (arrest and detection) are binary.

Ordinal Regression

To optimally develop explanatory models for illegal earnings, and stay faithful to the ordinal nature of the outcome, ordinal regression was chosen. By choosing ordinal regression, the ranking of the dependent variable, earnings from cannabis cultivation, is respected and information regarding the direction of the predictor variables on earnings is illustrated. The nature of the variable did not allow for Ordinary Least Squares Regression, which requires continuous data and a normal distribution (Tabachnick & Fiddell, 2007). Dichotomizing the dependent variable and using logistic regression would lose important ranking of the earnings categories.

The ordinal regression model is based on the assumption that there is a latent continuous outcome variable and that the observed ordinal variable comes from categorizing the underlying continuum. Ordinal regression is an extension of the binary logistic model, which uses the cumulative odds model, rather than the logit model, to predict the odds of being *at or below* a particular category. The model mimics a binary logistic regression for each of the splits in dependent variable yet it offers advantages over logistic regression and multinomial regression in that it provides a parsimonious

model and accounts for the rank ordering of the categories of the dependent variable, thereby respecting an important aspect of the data (O'Connell, 2006). There are few assumptions of ordinal regression but an important one is that there are proportional or parallel odds. That is, the independent variables have the same effect for each of the categories in the dependent variable, which allows one model to be sufficient to explain the relationship between the dependent variable and a set of predictors (O'Connell, 2006; Hosmer & Lemeshow, 2000). Each logit has its own threshold values (intercept) but the same co-efficient, which means that each predictor variable is the same for the different logit functions. Rejecting parallelism implies that there may be an interaction with the predictor variables and the splits in the dependent variable. For the earnings models, tests for parallel lines indicates that parallelism was achieved in all three models (p>.05).

In logistic regression, the link function transforms the dependent variable into a logit variable (natural log of the odds). In ordinal regression, different link functions can be applied to transform the ordinal response, depending on the probability that cases fall into each of the categories. In the case for my earnings variable, a negative log-log link was applied because the probability of cases falling into the lower categories is more likely. That is, the probability that the respondents would earn less money is greater than earning more money.

Chi-square Automatic Interaction Detector (CHAID)

The Chi-square Automatic Interaction Detector (CHAID) is a method is designed for uncovering sometimes complex interactions, which would be more difficult to detect using traditional techniques. It is a criterion-based method of segmentation. That is, the segmentation is based on a criterion variable (the dependent variable), whereas a non-criterion method of segmentation is not dependent on any single variable (e.g. cluster

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analysis). CHAID essentially involves creating many crosstabs and determining the most significant relationships to the dependent variable (based on the Chi-square value) to structure a tree, which is at the heart of a CHAID analysis (Hoare, 2004; Kass, 1980; Magidson, 1994). The sample is then divided further according to the values of that predictor and the selection procedure is repeated for each partition, until the most significant predictor is found. The tree stops developing once no further partitioning can be accomplished within the specified level of significance. The outcome of the partitioning process is the creation of more or less homogeneous groups with regard to the dependent variable (Silver & Chow-Martin, 2002). One of the advantages of CHAID is its flexibility. That is, it is a nonparametric method; it thus performs well with non linear, highly skewed variables, or those with an ordinal structure (Lewis, 2000), such as the ones considered here.

CHAID analysis has two important features that complement regression analysis. First, it can uncover interaction effects and profiles that may be more difficult with regression models. Interaction terms can also be added to regression models by manually interacting the factors or covariates. However, this manual method should be theoretically purposive because it would be labour intensive to interact all the factors in the model as an exploratory technique. In the CHAID however, all the variables of interest can be entered simultaneously and the algorithm distinguishes the combination of predictors that are important to the outcome variable.

For the all the CHAID analyses the p≤.10 critical value was used rather than the p≤.05 level for variable selection because of the reduced statistical power that accompanies smaller sample sizes. Parent nodes could not be split if they contained less than 25 cases and child nodes could only be included of it contains a minimum number of 10 cases. Tree depth was not specified.

3.2.2 Data Screening

There were few variables with missing values, but for the variables that did

contain some, the missing values were imputed with the EM algorithm. The variables

with the highest number of missing values were years experience with growing, hard

drug use, and type of site, at 10.9% each. Little's MCAR test, which is a chi-square test

for missing completely at random, revealed that there was no significant deviation from a

pattern of values that are "missing completely at random" ($p \geq .05$). This means that

none of the variables in the data set are related to the missing values of the variables of

interest (Meyers et al., 2006). Running the models using listwise deletion was

considered but doing so would result in a loss of 65 respondents, something that could

not be afforded given the small sample size. Hence, the EM algorithm was selected to

impute missing values.

EM algorithm is a general method for data imputation and is suggested to be

preferable to regression imputation (Tabachnick & Fidell, 2007). It consists of two steps,

expectation and maximization. The expectation step uses regression analysis to

estimate the missing values. The maximization step uses the maximum likelihood

estimates to estimate the parameters from the imputed missing values. The two steps

are repeated in an iterative process until it reaches convergence (Allison, 2002). This

method is devised to work under the assumption of the multivariate normal distribution,

but there is strong evidence that it works well with dichotomous variables if it is applied

with minor alterations (Allison, 2002).

Because the EM algorithm is a single imputation method, it has some drawbacks.

The main one being that it provides an *estimate* of the missing values, which may

contain some estimation error. Regression models that are conducted subsequent to

imputation however, do not account for such errors, and therefore underestimates the

standard error, resulting in smaller p values (higher chance of making a Type 1 error). Multiple imputation (MI) is generally considered to the best method for imputing missing values because it provides the most accurate results (Allison, 2002). The MI procedure builds in error variance by producing several complete data sets and then pooling them. MI is a new feature of SPSS 17.0 but CHAID is not one of the limited number of procedures that support the analyses of pooled data. Because the data are MCAR (missing completely at random) and there were few missing values, the EM method is expected to give consistent and unbiased estimates of the missing values.

To prepare for the regression models (ordinal and binary logistic), multicollinearity was tested with two standard methods. First, a correlation matrix was constructed and the correlation coefficients were assessed using Spearman's rho. Results show that no correlations were higher than .53 (between cannabis use and hard drug use). To further test if multicollinearity would pose a problem in the regression models, the variables from the models were entered into a linear regression models and the tolerance levels for each of the predictors were looked at. All the variables had a tolerance level of above .7, which indicates that multicollinearity is not a hindrance (Meyers et al., 2006). All analyses were conducted using SPSS 16.0.

4: RESULTS

The following chapter presents the results for the three-pronged analytical approach. The first section provides results for bivariate, ordinal regression and CHAID analyses for earnings from cannabis cultivation. The second section presents the findings for bivariate, logistic regression and CHAID analyses for arrest and detection. The last section in this chapter provides the results for bivariate and CHAID analyses for the sub-sample of the most successful participants. Results are discussed in chapter 5.

4.1 Criminal networks and earnings

The bivariate relationship between earnings and each of the independent variables was examined first. Table 2 presents the distribution for each earnings category and the chi-square test of significance. Five control variables: being an owner, working in commercial sites, working in multiple sites, years experience and drug dealing significantly differ between at least two earnings categories. As expected, there is a positive relationship between being an owner of a site, working in commercial sites, working at multiple sites and years of experience and the amount of money made. Note that individuals who earned more than $5000 (categories 6 and 7) all worked in commercial sites. This implies that the greater the involvement and intensity of participation in cultivation, the greater the instrumental returns. Interestingly, drug dealing appears to be the most prevalent among respondents in the highest earning categories (62.5% of individuals who earn $5001-10,000 and 47.1% of individuals who earn more than $10,000).

Three network variables emerge as statistically significant: gang membership, large youth network and number of co-offenders. Gang membership is the most prevalent among respondents in the highest two earnings categories with 37.5% and 47.1% respectively. Interestingly, the $1001-5000 category contained the lowest proportion of gang members. Embeddedness in large youth networks is also most common in the last two earnings categories, suggesting that there may be a relationship between gangs, large youth groups and greater involvement of participation in cannabis cultivation. The correlation matrix (Appendix A, Table 8) reveals that this is indeed the case: gang membership is positively and significantly correlated to being an owner ($r=.15$, $p\leq.05$), years experience ($r=.27$, $p\leq01$) and working at multiple sites ($r=.18$, $p\leq.05$). Large youth networks is positively and significantly correlated to being an owner ($r=.16$, $p\leq.05$) and working at multiple sites ($r=.21$, $p\leq.01$). There appears to be no relationship between the adult network variables (predominately adult network and large adult network) and illegal earnings, at least at the bivariate level. Not surprisingly, the median number of co-offenders is 3-4 except for the last two of the categories of earnings: For participants who earned $5001-10,000 the median number of co-offenders was 7 or more and for participants who earned more than $10,000 the median was 5-6 co-offenders. One likely explanation is that the number of co-offenders may also be an indication of the size of the cultivation site. Further examination of the correlations between number of co-offenders and commercial sites ($r=.31$, $p\leq.01$) and multiple sites ($r=.20$, $p\leq.01$) supports this assumption.

Contrary to expectations, neither regular hard drug use nor regular cannabis use are significantly related to illegal earnings. There also does not seem to be a direct relationship between illegal earnings and cost avoidance (arrest or detection). As expected, females are less likely to make money than their male counterparts and

accordingly, the highest earnings category that contained the lowest proportion of females (5.9%). Correlations reveal that females are significantly inversely related to being an owner (r=-.37, p≤.05) and working at multiple sites (r=-.15, p≤.05).

Table 2 Bivariate results predicting earnings from cannabis cultivation

	1	2	3	4	5	6	7	
	$0	$1-100	$101-500	$501-1,000	$1,001-5,000	$5,001-10,000	$10,000 +	χ2(p)
	N=38 (22.3	N=26 (14.9	N=41 (23.4	N=22 (12.6	N=22 (12.6	N=8 (4.6%)	N=17 (9.7%)	
Demographics:								
Gender (female=1)	41.0	30.8	39.0	50.0	27.3	12.5	5.9	12.07 (.06)†
Age (mean)	15.64	15.73	15.61	15.77	16.14	15.88	15.59	12.31 (.83)
Risk behaviours:								
Other crimes	53.8	65.4	46.3	63.6	54.5	75.0	58.8	4.31 (.64)
Drug dealing (last year)	20.5	11.5	26.8	22.7	22.7	62.5	47.1	13.24 (.04)*
Regular hard drug use	23.1	15.4	17.1	18.2	9.1	12.5	41.2	7.65 (.27)
Regular cannabis use	48.7	65.4	56.1	54.5	54.5	75.0	64.7	3.43 (.75)
Type of site (indoor =1)	38.5	46.2	26.8	45.5	27.3	37.5	58.8	7.60 (.27)
Intensity of involvement	48.7	42.3	58.5	68.2	81.8	37.5	82.4	15.60 (.02)*
Commercial site	30.8	34.6	56.1	72.2	81.8	100	100	43.16 (.00)***
Multiple sites (2+)	28.2	23.1	48.8	50.0	63.6	87.5	70.6	23.15 (.00)***
Years of exp growing (mean)	1.79	1.27	1.73	2.23	1.56	3.00	2.71	49.49 (.01)**
Network variables:								
Predom adult network	10.3	23.1	26.8	13.6	27.3	0.0	11.8	7.87 (.25)
Predom youth network	28.2	50.0	46.3	50.0	40.9	62.5	41.2	5.94 (.43)
Balanced network	48.7	23.1	22.0	27.3	22.7	37.5	41.2	9.80 (.13)
Large adult grower network	28.2	11.5	24.4	9.1	22.7	37.5	41.2	8.96 (.18)
Large youth grower network	28.2	11.5	22.0	27.3	40.9	87.5	58.8	25.35 (.00)***
Num of co-offenders (median)	3-4	3-4	3-4	3-4	3-4	7+	5-6	45.15 (.01)**
Gang membership	12.8	15.4	12.2	22.7	9.1	37.5	47.1	14.88 (.02)*
Arrested	15.4	15.4	12.2	22.7	22.7	12.5	17.6	1.95 (.92)
Detected	28.2	23.1	19.5	31.8	31.8	25.0	25.0	2.53 (.87)

†p≤ .10 *p≤ .05 **p≤ .01 ***p≤ .001

To test the relationship between the independent variables and earnings at the multivariate level, nested ordinal regression models were used. In order to limit the number of predictor variables, only control variables with significance below the .25 at the bivariate level were entered into the model. This cutting point is recommended when model building to ensure important variables are not excluded, hence reducing the likelihood of model misspecification (Hosmer et. al., 2008). All the network variables were tested, but in three stages, in order to avoid overloading the model. The first stage examined the impact of type of network (predominately adult or predominately youth) on earnings, the second stage explores the interaction between network type and large size, and the third stage is the best model, includes only the predictors in stages 1 and 2 that were significant below the .25 level. In all three stages, control variables were entered in the first model and network variables were introduced in the second (see Table 3).

In the first stage, model 1 is well fitted (χ^2=50.49 (6) p≤.001), with several positive significant predictors: multiple sites (β=.42, p≤.05), commercial sites (β=.93, p≤.001) and ownership (β =.40, p≤.05). Multivariate results in this model are consistent with the bivariate results; these variables indicate a greater intensity and frequency of involvement and arguably, commitment to cannabis cultivation. The model considerably improves with the network variables (χ^2=57.80 (10) p≤.001) and the Cox and Snell pseudo R^2 also improves (25% vs. 28%), explaining a little more than a quarter of the total variance. While working in a commercial site retains its significance, working at multiple sites and being an owner falls below the critical values once the network variables are included, suggesting an interaction between a respondent's role and/or working at multiple sites and type of network. Two of the network variables are significant: predominately adult (β =.51, p≤.05) and predominately youth (β =.51, p≤.01).

The β coefficients are both positive indicating that respondents who belong to either type of network are likely to earn more money than respondents in a balanced network. This finding is likely because half of the respondents (48.7%) who earned no money from cultivation are embedded in a balanced network. Despite the strong association between number of co-offenders and earnings at the bivariate level, the significance is lost at the multivariate level, likely due to its interaction with intensity related variables.

The second stage tested network type and large size. The chi-square model fit (χ^2=54.18 (10) p≤.001) is a little less than the type of network model in stage 1, but still very good. Here, commercial sites (β=.91, p≤.001) and multiple sites (β=.44, p≤.05) retain their significance and only one network variable, large youth network, is marginally related to earnings (b=.42, p≤.10). Interestingly, the direction of the coefficient is reversed with large adult network but does not reach significance. It suggests that the role of types of networks can differ with large sizes. Surprisingly, gang membership is not a significant predictor of illegal earnings even though it is significant at bivariate level.

The best model solution is the most parsimonious model with six of the eight predictors being significant (p≤.05) or marginally significant (p≤.10). Three network variables are positively related to earnings (predominately adult (β=.41 p≤.01), predominately youth (β=.41 p≤.10) and large youth (β=.54 p≤.05)) while large adult network remains negative and not significant. The most compelling finding of the earnings analyses is that net of the highly significant variables measuring intensity and frequency of involvement, an adolescent's network plays an important role in earning money from cannabis cultivation.

Table 3 Ordinal regression predicting earnings from cannabis cultivation

	Type of network		Type and size		Best Model	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
	b(S.E.)	b(S.E.)	b(S.E.)	b (S.E.)	b (S.E.)	b(S.E.)
Gender (female=1)	-.08(.20)	-.12(.21)	-.08(.20)	-.13(.20)	-	-
Drug dealer (last 12 months)	.19(.19)	.14(.19)	.19(.19)	.13(.19)	-	-
Years of experience	.07(.06)	.07(.07)	.07(.06)	.08(.07)	.07(.06)	.08(.06)
Multiple sites	.42(.19)*	.46(.19)	.42(.19)*	.44(.19)*	.46(.18)**	.52(.19)**
Commercial site	.93(.20)***	.89(.21)***	.93(.20)***	.91(.21)***	.96(.20)***	.92(.20)***
Intensity of involvement (owner=1)	.40(.19)*	.48(.20)	.40(.19)*	.32(.20)	.47(.18)**	.43(.19)*
Gang member	-	.08(.24)	-	-.06(.24)	-	-
Predominantly adult network	-	.51(25)*	-	-	-	.41(.23)**
Predominantly youth network	-	.51(.21)**	-	-	-	.41(.23)†
Large adult network	-	-	-	-29(.24)	-	-.25(.28)
Large youth network	-	-	-	.42(.22)†	-	.54(.24)*
Number of co-offenders	-	.05(.08)	-	.03(.08)	-	-
Thresholds						
1	.63(.26)**	1.04(.33)**	.63(.26)**	.66(.29)	.65(.23)**	1.03(.29)***
2	1.11(.27)***	1.55(.34)***	1.11(.27)***	1.14(.30)***	1.12(.24)***	1.53(.30)***
3	1.90(.29)***	2.36(.36)***	1.90(.29)***	1.94(.32)***	1.91(.27)***	2.36(.33)***
4	2.42(.31)***	2.89(.38)***	2.42(.31)***	2.47(.33)***	2.44(.28)***	3.69(.37)***
5	3.18(.34)***	3.66(.41)***	3.18(.34)***	3.25(.36)***	3.20(.32)***	4.12(.40)***
6	3.61(.37)***	4.09(.43)***	3.61(.37)***	3.69(.000)***	3.63(.35)***	3.67(.35)***
χ2(p)	50.49(.000)	57.80(.000)	50.49(.000)	54.18(.000)	49.32(.000)	61.25(.000)
Cox and Snell pseudo R^2	.25	.28	.25	.27	.25	.30

†p≤ .10 *p≤ .05 **p≤ .01 ***p≤ .001

To explore the interaction effects and profiles that are associated with substantial earnings, a CHAID analysis was conducted. Although CHAID can handle ordinal dependent variables, it has the most power and its results are the easiest to interpret when the outcome variable is dichotomous (Magidson, 1994). In order, to increase statistical power and prepare for CHAID analysis, the respondents with the greatest instrumental returns (more than $5000) were isolated by dichotomizing the dependent variable. This cutting point was chosen by comparing the chi-square value of each of the earnings categories to the previous category against the independent variables. The cut-off between category four (earning $1001-5000) and category five (earning more than $5000) have the most statistically significant difference.

Figure 1 Classification Tree (CHAID) analysis with substantial earnings ($5000+) as the predicted outcome

```
                    ┌─────────────────────┐
                    │  Substantial Earner │
                    │    Mean = 14.3%     │
                    │      N = 175        │
                    └─────────────────────┘
              ┌─────────────┴─────────────┐
    ┌──────────────────┐        ┌──────────────────┐
    │  Non commercial  │        │    Commercial    │
    │  Mean = 0.0%     │        │  Mean = 24.3%    │
    │     N=72         │        │    N = 103       │
    └──────────────────┘        └──────────────────┘
                          ┌────────────┴────────────┐
              ┌──────────────────────┐   ┌──────────────────────┐
              │No large youth network│   │  Large youth network │
              │   Mean = 12.1%       │   │    Mean = 45.9%      │
              │     N = 66           │   │      N = 37         │
              └──────────────────────┘   └──────────────────────┘
              ┌─────────┴─────────┐      ┌─────────┴─────────┐
      ┌──────────┐    ┌──────────┐  ┌──────────────┐  ┌──────────────┐
      │  Males   │    │ Females  │  │Non gang member│  │ Gang member  │
      │Mean=17.5%│    │Mean=3.8% │  │ Mean = 30.4% │  │ Mean = 71.4% │
      │  N = 40  │    │  N = 26  │  │   N = 23     │  │   N = 14     │
      └──────────┘    └──────────┘  └──────────────┘  └──────────────┘
```
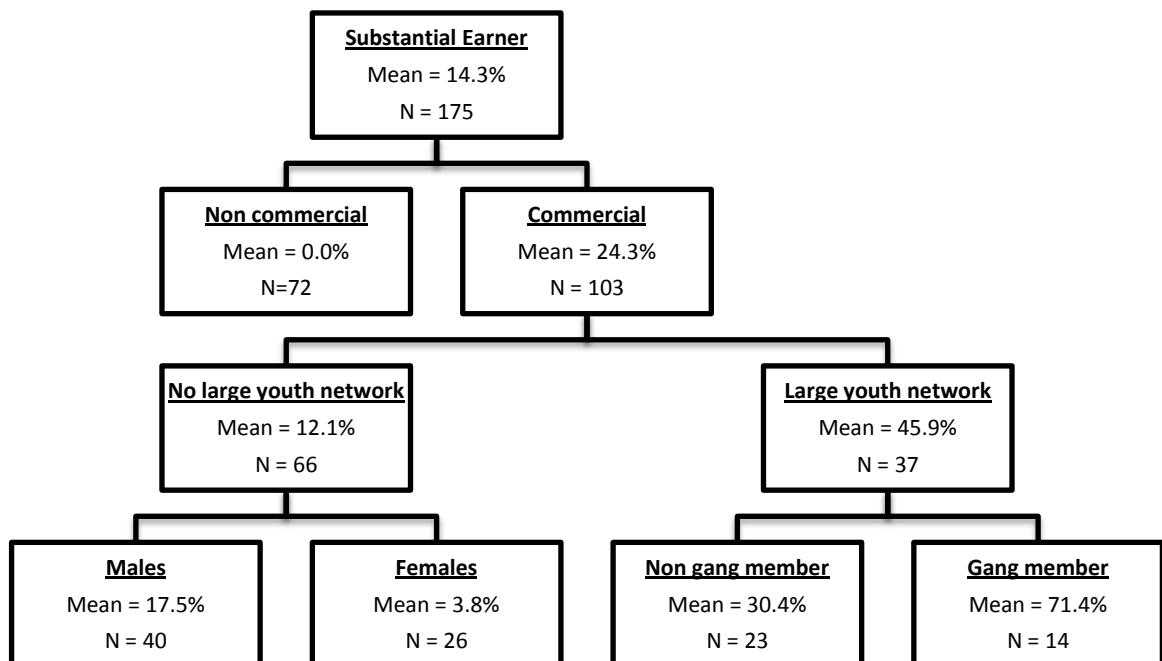
Figure 1 illustrates that working in a commercial site is the most significant

predictor of earning a substantial amount of money from cultivation. None of the

respondents who worked at non-commercial sites earned more than $5000, unlike

nearly a quarter (24.3%) of individuals who worked in commercial sites did. Because

all of the respondents who worked in commercial sites earned more than $5,000, the

CHAID was re-ran without commercial sites to test if the variable affected the profiles.

Results were similar so commercial sites was included for illustrative purposes. Of the

quarter of respondents who worked in commercial sites there is an interaction with

three other variables, suggesting the presence of interaction effects and distinct

profiles within each category. This is where the relationship between earnings and

large youth network is uncovered: Close to half the participants (45.9%) who have a

large youth network and worked in commercial sites are substantial earners compared

to only 12.1% who are not embedded in a large youth network. The odds of making

substantial money are further increased if respondents who belong to a large youth

network are also gang members (71.4%). Conversely, even if a female worked in a

commercial site, if she is not embedded in a large youth network, her odds of earning

a substantial amount is very low (3.8%). CHAID analyses reveals that criminal

networks may play a role in instrumental returns, especially for gang members

embedded in large youth networks who work in commercial sites. The next step is

testing whether the same holds for expressive returns.

4.2 Criminal networks and cost avoidance

To explore the role of criminal networks and cost avoidance, the same iterative

process as for earnings was used. The bivariate relationship between arrest and each of

the independent variables (Table 4) was examined first. Table 4 illustrates that only 2

variables are significantly related to arrest: type of site (p≤.001) and predominantly adult

network (p≤.05). Consistent with expectations, the odds of being arrested are higher for growers who participated in indoor cultivation sites (29.9% vs. 8.3%). Surprisingly, the odds of arrest are much lower for respondents who are embedded in an adult grower network (3.1% vs. 19.6%). Recall that the odds of arrest for the entire sample are 16.6%. Interestingly, only one grower embedded in an adult network was arrested overall. Variables that are moderately significant was also considered and it was found that years of experience was related to odds of arrest. Contrary to the results for adult network, the relationship between predominately youth network is positive, but did not reach significance: growers who are embedded in a youth network are arrested more often than others (21.3% vs. 13.0%). Participants in a balanced network were also on par in regards to arrest: they were no more, or no less likely to be arrested than their counterparts (14.5% vs. 17.5%).

The interaction of network type and large size does not appear as strong as type of network. Table 4 shows that there is no significant relationship between embeddedness in a large adult grower network or a large youth network and the odds of arrest. Note however that large adult grower network and large youth network are significantly correlated with one another (r=.47, p≤.01), suggesting that a number of respondents are hyperconnected (involved in a network of over 30 growers including youth and adults). Regular cannabis use increases the odds of arrest (20.0% vs. 12.0%) but regular hard drug users fare no better or no worse (17.6% vs. 16.3%).

Table 4 Bivariate results predicting arrest for cannabis cultivation and having participated in a detected cultivation site

	% Arrested			% Detection		
	YES (%)	NO (%)	χ2(p)	YES (%)	NO (%)	χ2(p)
Demographics:						
Gender (female=1)	16.9	16.4	.01 (.92)	25.4	27.6	.09 (.76)
Age (mean)	15.8 (arr.)	15.7 (n-arr)	.44 (.93)	15.8 (det)	15.7 (n-det)	1.45 (.67)
Risk behaviours:						
Other crimes	15.2	18.4	.33 (.56)	26.3	27.6	.04 (.84)
Drug dealing (last year)	18.2	14.9	.33 (.56)	22.7	31.0	1.54 (.22)
Regular hard drug use	17.6	16.3	.04 (.80)	29.4	26.2	.14 (.71)
Regular cannabis use	20.0	12.0	1.98 (.16)	29.0	24.0	.55 (.46)
Type of site (indoor =1)	29.9	8.3	13.85 (.00)***	40.3	18.5	9.99 (.00)**
Intensity of involvement (Owner = 1)	19.2	12.7	1.31 (.25)	26.9	26.8	.00 (.98)
Commercial site	17.1	15.3	.15 (.70)	29.1	23.6	.65 (.42)
Multiple sites (2+)	14.8	18.1	.34 (.56)	27.2	26.6	.01 (.93)
Yrs of exp growing (mean)	2.28 (arr)	1.79 (n-arr)	9.66 (.09)†	2.23 (det)	1.73 (n-det)	8.65 (.12)
Network variables:						
Gang member	15.6	16.8	.03 (.87)	37.5	24.5	2.26 (.18)
Predom adult network	3.1	19.6	5.12 (.02)*	9.4	30.8	6.09 (.01)**
Predom youth network	21.3	13.0	2.15 (.14)	30.7	24.0	.97 (.33)
Balanced network	14.5	17.5	.24 (.63)	27.3	26.7	.01 (.93)
Lrg adult grower network	12.2	17.9	.74 (.39)	22.0	28.4	.66 (.42)
Lrg youth grower network	20.0	15.0	.68 (.41)	34.5	23.3	2.41 (.12)
Number of co-offenders	3-4 (arr)	3-4 (n-arr)	1.96 (.74)	3-4 (det)	3-4 (n-det)	2.65 (.62)

†p≤ .10 *p≤ .05 **p≤ .01 ***p≤ .001

Note that similar results are found once the analysis was extended to consider the respondents who participated in a detected site but were not arrested (Table 4). New

variables emerged as potentially associated to detection: gang membership, large youth

grower network, and drug dealing. The relationship between gang membership and

detection is positive (37.5% vs. 24.5%) as is the relationship between large youth

network and detection (34.5% vs. 23.3%). Note that gang membership is also

significantly correlated with another risk factor – working in indoor cultivation sites (r=.24,

p≤.01). Surprisingly, drug dealing appears to be a protective rather than a risk factor.

Contrary to the group hazard hypothesis, there appears to be an absence of a

relationship between direct co-offending and cost avoidance. This might indicate that an

offender's larger criminal network is more pertinent to cost avoidance issues. In spite of

their important impact on earnings, gender, being an owner, working in commercial sites

and working at multiple sites are not significantly related to the odds of arrest.

Next, the relationships between arrest/detection and the independent variables

were tested at the multivariate level by using a nested logistic regression model. Using

the same strategy as for earnings, control variables with significance levels over .25 (for

either arrest or detection) were not considered. The first stage examined the role of

network type (predominantly youth/ adult) on arrest, the second stage looked at the

interaction of network type and large size, and the third one is the best model, which

only included variables shown to be significant or close to significance. At each stage,

criminal network variables were introduced in model 2, after the controls were entered in

model 1.

Table 5 Logistic regression predicting arrest for cannabis cultivation

	Network type		Network size + type		Best model	
	Model 1	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
	B (S.E.)	**B (S.E.)**	**B (S.E.)**	**B (S.E.)**	**B (S.E.)**	**B (S.E.)**
Years of experience	.12(.14)	.25(.16)	.12(.14)	.20(.15)	.12(.14)	.24(.16)
Drug dealing	-.09(.51)	-.25(.55)	-.09(.51)	-.10(.54)	-	-
Type of site	1.69(.47)***	2.10(.55)***	1.69(.47)***	2.15(.53)***	1.70(.47)***	2.09(.55)***
Regular cannabis use	.67(.53)	.84(.56)	.67(.53)	.85(.56)	.63(.46)	.78(.51)
Intensity of involvement	.88(.48)†	1.41(.56)**	.88(.48)†	1.18(.53)*	.87(.47)†	1.37(.55)*
Gang member	-	-1.31(.66)*	-	-1.46(.67)*	-	-.1.31(.66)*
Predominantly adult network	-	-1.67(1.12)	-	-	-	-1.74 (1.12)
Predominantly youth network	-	.63(.51)	-	-	-	.40(.59)
Large adult network	-	-	-	-1.07(.67)	-	-.50(.70)
Large youth network	-	-	-	.63(.58)	-	-
Number of co-offenders	-	-.02(.19)	-	-.02(.19)	-	-
Constant	-3.64(.65)***	-4.32(.93)***	-3.64(.65)***	-4.01(.81)***	-3.65(.64)***	-4.19(.86)***
Overall % predicted	81.7	83.4	81.7	84.0	81.7	84.0
χ2(p)	20.46(.00)	33.11(.00)	20.46(.00)	28.84(.00)	20.42(.00)	33.39(.00)
Cox and Snell pseudo R^2	.11	.17	.11	.15	.11	.17

†p≤ .10 *p≤ .05 **p≤ .01 ***p≤ .001

Generally, the models greatly improve once the network variables were included. Conside r the first stage in model 1, the model is significant (χ^2 = 20.5 (5) p≤.001), but only one significant predictor emerged: type of site (β=1.69, p≤.001). The coefficient is positive, indicating that working on an indoor site is associated with a higher risk of arrest. Being an owner is marginally significant risk factor (β=.88 p≤.10). The model greatly improves when the criminal network variables are added in the second block (χ^2

= 33.11 (8) p ≤ .001). The Cox and Snell pseudo R^2 also greatly improves, explaining

17% of the total variance. Being an owner improved its significance (β=1.14 p≤.01)

suggesting an interaction between the role of a participant and his/her criminal network.

Gang membership is the only network variable at this stage to surface as significant.

Surprisingly, the negative coefficient suggests that gang membership may be a

protective, rather than risk factor in regards to arrest. Interestingly, the co-efficients of

adult network and youth network are reversed, consistent with findings at the bivariate

level. Adolescents working with, or surrounded by adult growers are rarely arrested as a

consequence of participation in the cultivation industry whereas the coefficient for youth

networks is positive, indicating that embeddedness in youth networks is a risk factor.

The findings however, do not reach significance at the multivariate level after controlling

for other factors.

Similar results were found when network type with size are interacted, at stage 2:

having a large adult grower network is negatively related to arrest, whereas the opposite

is true for large youth networks (Table 5). Despite the fact that the variables are not

statistically significant, the directional differences in the age composition and odds of

arrest suggests specifying networks according to age is an avenue worth exploring. The

best model solution (Table 5) remains essentially the same. Across the arrest models,

several predictors do not emerge as significant but are nevertheless worth noting. Years

of experience and regular cannabis use are both positive (not significant) predictors of

arrest. These findings were expected: increased experience is related to increased

opportunities for apprehension associated with longer participation in the cultivation

industry. Similarly, the positive result for cannabis use could reflect the increased

visibility and recklessness that might come with heavy use, increasing the likelihood of

law enforcement apprehension compared with simply being involved in cultivation.

To increase statistical power and to assess whether any differences would arise, the same models using detection as the dependent variable were ran. There were many similarities with the arrested model but some differences are worth noting (see Table 6). First, growers who are also involved in drug dealing are less likely to be detected than others. This result may reflect the kind of environment in which grower-dealer operates, something that will be explicitly considered in the CHAID analysis. Second, gang membership no longer appears to be a protective factor. Gang membership remains non-significant throughout all stages, indicating that many gang members participate in a site that was eventually detected, without being arrested themselves (Table 6). Third, being embedded in a youth network does not appear to be a risk factor as such (stage 1), but it can become risky with large sizes (stage 2): being embedded in a large youth network significantly increased the odds of having participated in a detected site ($\beta=1.08$, $p\leq.05$). The significant effect was lost, however, once the best model solution was ran.

Adults appear to have a stronger protective effect against detection than arrest. Respondents embedded in both adult networks ($\beta=-1.45$, $p\leq.05$) and large adult networks ($\beta=-1.00$, $p\leq.10$) are at significantly lower odds of detection. Years of experience, drug dealing, and indoor sites emerge as the most significant predictors at that last stage. Yet, the same reverse effect remains: a large grower network size is only risky when network members include a majority of youths. Adult networks remain a protective factor.

Table 6 Logistic regression models predicting participation in a detected cultivation site

	Network type		Network size + type		Best model	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
	B (S.E.)	B (S.E.)	B (S.E.)	B (S.E.)	B (S.E.)	B (S.E.)
Years of experience	.21(.13)†	.24(.14)†	.21(.13)†	.19(.13)	.21(.13)†	.23(.13)†
Drug dealing	-.82(.43)†	-1.01(.47)*	-.82(.43)†	-1.01(.03)	-.78(.43)†	-.98(.48)*
Type of site	1.02(.37)**	1.01(.40)**	1.02(.37)**	1.10(.39)**	.96(.36)**	.98(.38)**
Regular cannabis use	.69(.43)	.76(.46)†	.69(.43)	.64(.45)	.69(.43)	.68(.46)
Intensity of involvement	.32(.38)	.40(.40)	.32(.38)	.28(.40)	-	-
Gang member	-	.02(.49)		-.08(.49)	-	-
Predominantly adult network	-	-1.45(.71)*	-	-	-	-1.19(.72)†
Predominantly youth network	-	.25(.40)	-	-	-	-
Large adult network	-	-	-	-1.00(.53)†	-	-.79(.56)
Large youth network	-	-	-	1.08(.48)*	-	.81(.51)
Number of Co-offenders	-	.09(.16)	-	.05(.17)	-	-
Constant	-2.06(.47)***	-2.25(.65)***	-2.06(.47)***	-2.18(.59)***	-1.87(.41)***	-1.78(.42)***
Overall % predicted	73.7	73.7	73.7	73.7	73.1	71.4
χ2(p)	16.82 (.01)	24.55(.00)	16.82 (.01)	23.27(.01)	16.01(.00)	26.00(.00)
Cox and Snell pseudo R^2	9%	13%	9%	13%	9%	14%

†p≤ .10 *p≤ .05 **p≤ .01 ***p≤ .001

CHAID analyses

To further explore the relationship between criminal networks and cost avoidance two separate CHAID analyses were conducted: one with arrest and one with detection. Figure 2 shows the results of the CHAID analysis for arrest. Consistent with the results of the logistic regression (best model, Table 5), the analysis suggests that type of site is the most significant variable in terms of odds of arrest. Indoor growers are arrested more

than twice as often as outdoor growers (29.9% vs. 8.3%). Yet, each variable interacts with one or two additional variables, suggesting the presence of interaction effects and distinct profiles within each category. This is where the risks for respondents embedded in youth networks are revealed. Indoor growers who belong to predominately youth networks are twice as likely to be arrested as those who are embedded in adult or balanced networks (44.0% vs. 21.4%). This finding confirms the importance of network type in assessing the odds of being arrested. Figure 2 illustrates that outdoor sites drastically reduce the chances of arrest if adolescents do not use cannabis regularly (0.0% vs. 14.5%). If however, a youth works in an outdoor site, uses cannabis regularly and owns the site, the risks are heighted (22.5%), whereas none of the labourers in the same position were arrested.

Figure 2 Classification Tree (CHAID) analysis with arrest as the predicted outcome
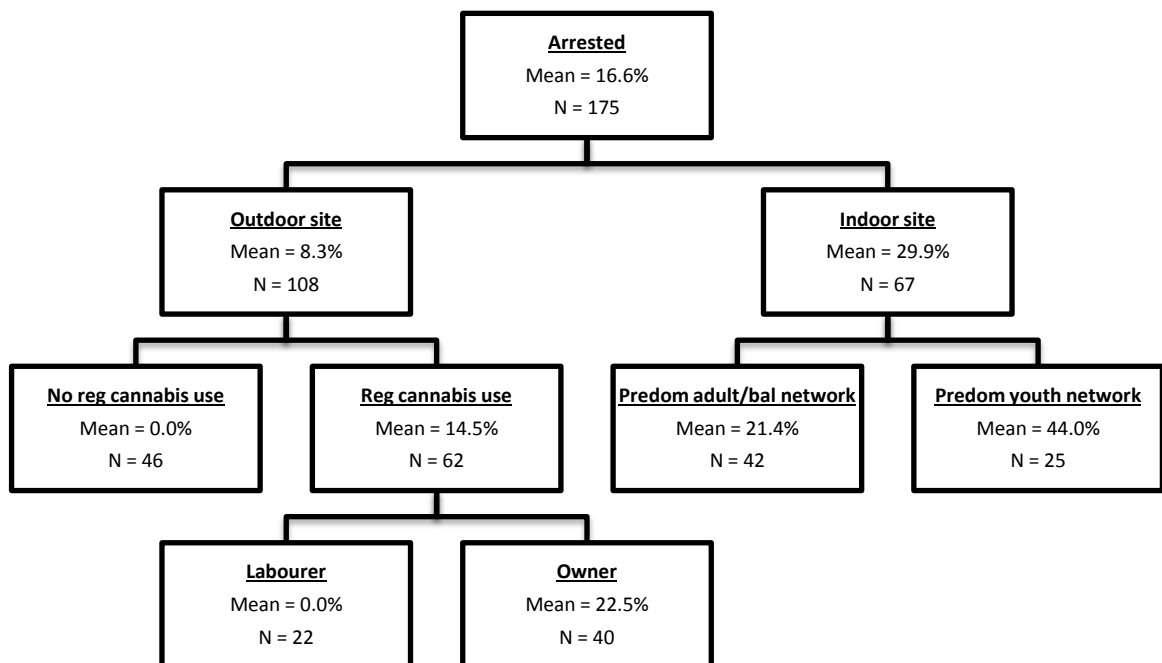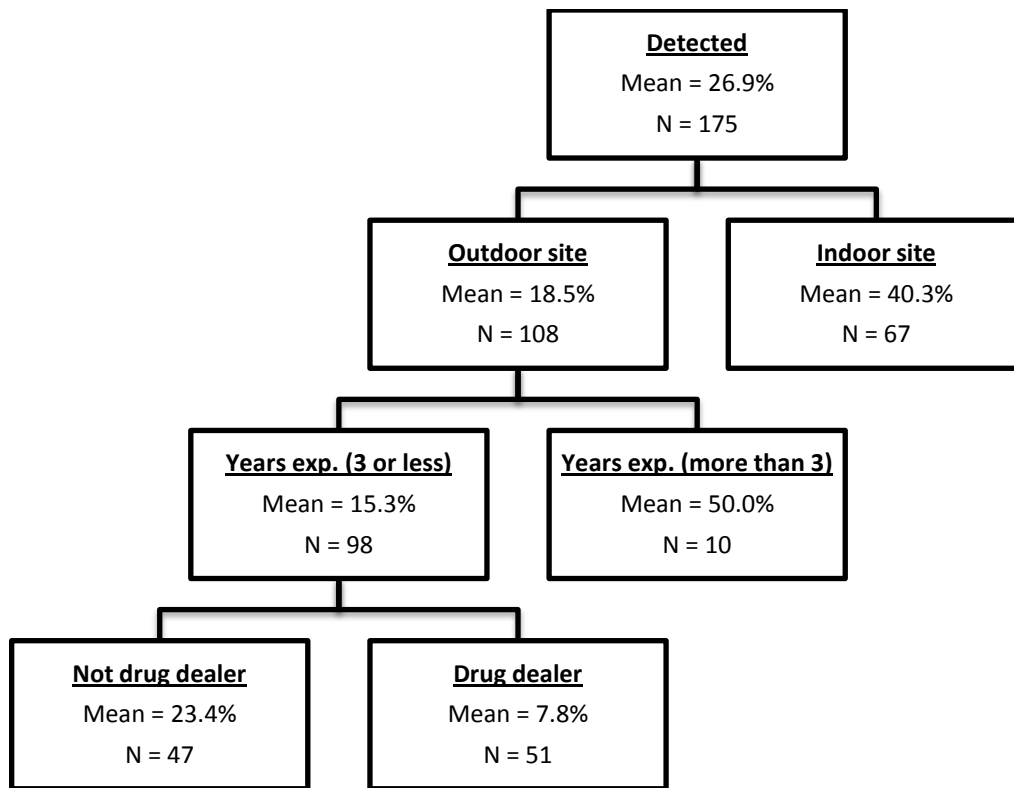
Figure 3 Classification Tree (CHAID) analysis with detection as the predicted outcome

```
                          ┌─────────────────┐
                          │    Detected     │
                          │  Mean = 26.9%   │
                          │    N = 175      │
                          └────────┬────────┘
                  ┌────────────────┴────────────────┐
         ┌────────┴────────┐              ┌──────────┴──────┐
         │  Outdoor site   │              │   Indoor site   │
         │  Mean = 18.5%   │              │  Mean = 40.3%   │
         │    N = 108      │              │    N = 67       │
         └────────┬────────┘              └─────────────────┘
         ┌────────┴──────────────┐
┌────────┴────────────┐  ┌────────┴─────────────┐
│ Years exp. (3 or     │  │ Years exp. (more     │
│ less)                │  │ than 3)              │
│  Mean = 15.3%        │  │  Mean = 50.0%        │
│    N = 98            │  │    N = 10            │
└────────┬────────────┘  └──────────────────────┘
   ┌─────┴──────────────┐
┌──┴──────────┐  ┌───────┴──────┐
│ Not drug    │  │  Drug dealer │
│ dealer      │  │  Mean = 7.8% │
│ Mean = 23.4%│  │    N = 51    │
│   N = 47    │  │              │
└─────────────┘  └──────────────┘
```

The classification tree developed for detection reveals a slightly different picture (Figure 3). Type of site remains the most important variable: 40.3% of participants who worked in indoor sites were detected compared to only 18.5% of participants who worked in outdoor sites. Outdoor sites interacts with two other variables and provide some insight into some of the findings in the logistic regression. Even though working in an outdoor site is a protective factor, if a grower remains in the industry long enough, his/her chances of participating in a detected sight are high. Half of the respondents who had more than three years experience and who worked in an outdoor site reported detection whereas their less experienced counterparts (3 years or less experience) are much lower (15.3%) risks of detection. The risks of working in a detected site are further reduced when those who have three years or less experience are drug dealers (7.8%).

Findings here suggest that participating in a detected site and being arrested are essentially different. How do these 18 respondents differ from the 29 who were arrested? Additional analyses (Appendix A, Table 9) shows that participants who are arrested are significantly or almost significantly more likely to be drug dealers, work in indoor sites and owners of their own site than respondents who participated in a detected site but not arrested themselves. Conversely, adolescents who were arrested were less likely to be gang members than respondents who participated in a detected site.

4.3 Profile of successful youth

The findings of the previous analyses suggest that factors that are related instrumental returns (illegal earnings) are not necessarily related to expressive returns (cost avoidance). For example, variables that measure intensity of involvement (commercial sites and multiple sites) are strongly predictive of greater earnings but are not related to cost avoidance. Working in indoor sites significantly heightens one's odds of arrest, but is trivial in terms of earnings. The effects of criminal networks also differ depending on the type of returns: belonging to a large youth network benefits adolescents in terms of earnings but can be detrimental in terms of cost avoidance. Being embedded in adult networks aids in both earnings attainment and cost avoidance but the effects of adults in large numbers is unclear. These results lend partial support to Lin's theory of social capital and will be specifically tackled in the discussion in chapter 5.

What are the risk-reward trade-offs for the respondents of this study? To investigate the factors that are related to both illegal earnings and cost avoidance, the most criminally successful participants were isolated (12%, n=21) and compared them to the rest of the sample on the independent variables. Successful was defined as respondents who earned more than $5000 and have never been arrested (see Table 7).

Table 7 Description of successful youth who participate in cannabis cultivation

	YES %	NO %	Effect size	χ2(p)
			$5000 and no arrest N=21 (12%)	
Demographics:				
Gender (female=1)	3.4	16.4	-.19	6.25 (.01)**
Age (mean)	15.57 success	15.75 n-success	.08	1.10 (.78)
Risk behaviours:				
Other crimes	14.1	9.2	.08	.99 (.32)
Drug dealing (last year)	15.9	8.0	.12	2.56(.11)
Regular hard drug use	20.6	9.9	.13	2.95 (.09)†
Regular cannabis use	14.0	9.3	.07	.88 (.35)
Type of site (indoor =1)	16.4	9.3	.11	2.01 (.16)
Intensity of involvement (Owner = 1)	13.5	9.9	.05	.52 (.47)
Commercial site	20.4	0.0	.31	16.68 (.00)***
Multiple sites (2+)	21.0	4.3	.26	11.54 (.00)***
Years of exp growing (mean)	2.90 success	1.73 n-success	.28	13.78 (.02)*
Network variables:				
Predominantly adult network	6.2	13.3	-.08	1.23 (.27)
Predominantly youth network	13.3	11.0	.04	.22 (.64)
Balanced network	14.5	10.8	.05	.49 (.48)
Large adult grower network	19.5	9.7	.13	2.86 (.09)†
Large youth grower network	23.6	6.7	.24	10.29 (.001)***
Number of co-offenders (median)	5-6 success	3-4 n-success	.28	13.25 (.01)**
Gang member	31.2	7.7	.28	13.74 (.000)***

†p≤ .10 *p≤ .05 **p≤ .01 ***p≤ .001

As expected, compared to males, females are very unlikely to be successful (3.4% vs. 16.4%). Intensity related variables remained statistically significant: working in

commercial sites (20.4% vs. 0.0%), working at multiple sites (21.0% vs. 4.3%) and years experience are all positive predictors of being successful.

Two network variables are positively related to overall success: gang membership (31.2% vs. 7.7%) and large youth network (23.6% vs. 6.7%). Suggesting that their high prevalence with those earning $5,000 or more (see table 2) are very important and are retained even when interacted with arrest. The median number of co-offenders for the successful group is 5-6 compared to 3-4 for the rest of the sample. Number of co-offenders may be indicative of the size of the cultivation site, and hence not surprising. Unexpectedly, a number of risk factors (other crimes, drug dealing, regular hard drug use, type of site, being an owner) are positively related to success but do not reach significance. One likely explanation that these relationships are positive is that these risk factors are also associated to gang membership and embeddedness in large youth networks. Being embedded in an adult network is negatively associated with success (6.2% vs. 13.3%) but having a *large* adult network becomes helpful with attaining success (19.5% vs. 9.7%).

Logistic regression was conducted to assess the relationship between the independent variables and success at the multivariate level. However, due to the few cases in the dependent variable (n=21), the results were highly unstable and unreliable. Therefore, CHAID, which has fewer assumptions than logistic regression, was carried out to explore the profiles of the most successful respondents.

Figure 4 Classification Tree (CHAID) analysis with success as the predicted outcome

```
                        ┌─────────────────────┐
                        │     Successful      │
                        │   Mean = 12.0%      │
                        │     N = 175         │
                        └─────────────────────┘
                    ┌────────────┴────────────┐
        ┌───────────────────────┐   ┌───────────────────────┐
        │   Non commercial      │   │     Commercial        │
        │   Mean = 0.0%         │   │   Mean = 20.4%        │
        │     N = 72            │   │     N = 103           │
        └───────────────────────┘   └───────────────────────┘
                              ┌────────────┴────────────┐
                  ┌───────────────────────┐   ┌───────────────────────┐
                  │   Non gang member     │   │    Gang member        │
                  │   Mean = 13.8%        │   │   Mean = 43.5%        │
                  │     N = 80            │   │     N = 23            │
                  └───────────────────────┘   └───────────────────────┘
                    ┌────────────┴────────────┐
        ┌───────────────────────┐   ┌───────────────────────┐
        │      Males            │   │     Females           │
        │   Mean = 19.2%        │   │   Mean = 3.6%         │
        │     N = 52            │   │     N = 28            │
        └───────────────────────┘   └───────────────────────┘
```
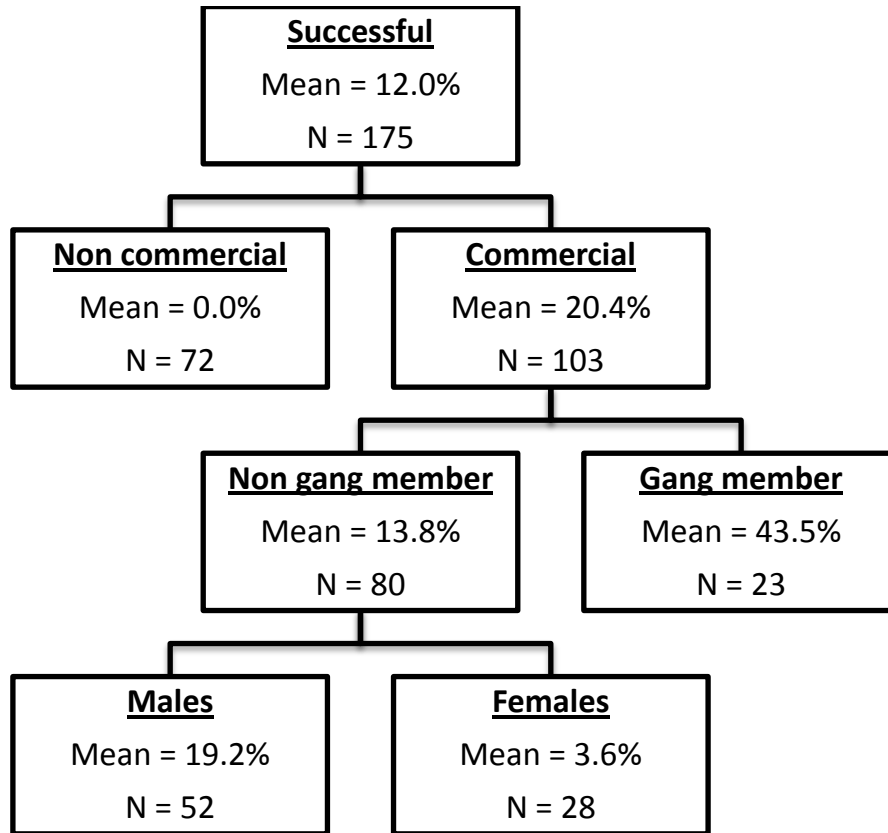
Figure 4 shows that working in commercial sites is the most important predictor of success. A fifth (20.4%) of the participants who worked in commercial sites are successful but none of the participants who worked in non-commercial sites reached success. The second most important predictor of success is gang membership. If a gang member works in a commercial site, his/her odds of being successful are 43.5% compared to 13.8% for non-gang members. However, the odds of success for non-gang members who work in commercial sites actually increase if the respondent is a male. For female non-gang members who work in commercial sites, aspirations of success seem futile (3.6%). The balance between risks and rewards is delicate. The findings here suggest that when considering criminal success, there are trade-offs but the balance appears to tip towards factors associated with earnings rather than cost avoidance. Respondents have more decision making power as it relates to the intensity of

participation whereas cost avoidance is dependent on many external factors (e.g.

targeted police efforts, informants) that are beyond an offender's control.

5: DISCUSSION

The main goal of this thesis is to explore the impact of criminal networks on criminal achievement. Lin's (2001) network theory of social capital provides guidance by differentiating between two types of actions in which social capital can be used. He proposed that individuals mobilize resources embedded in their social networks for two types of actions: instrumental actions, where efforts are aimed at acquiring valued resources not yet at one's disposal (such as money) and expressive actions, where efforts are aimed at maintaining or preserving valued resources already at one's disposal (such as health or freedom). Lin also described the network structures that are advantageous to each action: open, heterophilious networks are beneficial to instrumental returns while closed, homophilious networks are beneficial to expressive returns.

This study focuses on youth involved in cannabis cultivation. Fortunately, access to data on a region known for its extensive cannabis cultivation industry was available. The data offer not only rich, offence-specific information on the nature of youth involvement but also information on the type and size of participants' cultivation networks. Initially, it was difficult to predict which network variables would contribute to greater earnings and whether the same ones would hold for avoiding arrest. This thesis finds that networks help for making money and both hinder and help regarding cost avoidance, depending on which network a participant is embedded in. In addition to networks, several other factors play a role in instrumental and expressive returns. The following chapter will first discuss the results concerning instrumental returns; second,

findings involving expressive returns will be reviewed; and lastly results pertaining to both instrumental and expressive returns will be discussed.

5.1 Instrumental returns

Criminal achievement literature has found that networks are important to instrumental returns. More specifically, offenders who have more nonredundant contacts (Morselli & Tremblay, 2004), who are open to collaboration (McCarthy & Hagan, 2001), report knowing more successful offenders (Tremblay & Morselli, 2000), and have mentors in their criminal network (Morselli et al., 2006) have greater criminal earnings. It was therefore hypothesized that networks are beneficial to earnings from cannabis cultivation.

Type of network is one of the network dimensions of interest and is defined as predominately adult networks (heterophilous ties) or predominately youth networks (homophilious ties). According to Lin (2001; 2005), heterophilous ties (contacts with dissimilar characteristics and resources) are valuable to instrumental gains because they provide access to new information and provide diversity of resources embedded in networks. It was therefore expected that participants who are embedded in adult networks would earn more money than those who are not. However, findings for type of network on earnings are unclear. Results in the ordinal regression show that compared to being embedded in a balanced network, both types of networks (predominately adult and predominately youth) emerge as significant positive predictors for earning more money. But, neither variable is significant in the bivariate or CHAID analysis. The significant findings in the ordinal regression is hypothesized to be due to the large number of participants embedded in balanced networks who earned no money as a result of their participation in cannabis cultivation (48.7%, n=19). To further explore this, additional analyses was conducted and the reference group was switched from a

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balanced network to a predominately youth network. Results confirm that compared to being in a youth network, embeddedness in an adult network is not significant to the amount of money a participant earns from cannabis cultivation. Thus, contrary to expectations, based on Lin's assertion that heterophilious ties aid in instrumental returns, participants in networks with more adult growers do not earn more money.

The impact of size of network on earnings is more apparent than the impact of type of network. This result has been demonstrated in social capital literature: Burt (2000) found that across five samples of managers from medium to large organizations, network size was significantly related to higher earnings. Similar results are found here. Bivariate and multivariate analyses show that participants embedded in large youth networks make more money than those who are not a part of a large network of youth. CHAID analysis further reveals that for making substantial earnings (earning $5000 or more), embeddedness in a large youth network is the second most important predictor, after working on commercial sites. The effect of embeddedness in a large adult network however, failed to reach significance in the bivariate or multivariate analyses and therefore is not as clear as for respondents in large youth networks.

For instrumental returns, it appears that size is more important that type of network alone. There are several mechanisms that could underlie these network findings. First, adolescents who know a large number of other youth who participate in cannabis cultivation are more likely to own or co-own the sites ($r=.16$, $p<.05$). This effect is much smaller for adolescents embedded in a large adult network ($r=.07$, $p>.05$), suggesting that many adolescents in large adult networks often occupy secondary roles as hired labourers (34.1%). Being an owner indicates a deeper commitment to cultivation and is more conducive to earning money than being occasional hired labourers.

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Second, Burt (2000) hypothesized that the more contacts an individual has, the more likely he/she will receive information and opportunities. Similarly, criminological research suggests that offenders use their contacts to broaden their offending opportunities and increase their frequency of offending. According to Snook (2004), who examined the distances travelled by serial burglars, co-offenders combine resources to increase their scope of offending. Potter (2006) also indentified cannabis production cooperatives and franchises, suggesting the existence of joint efforts among growers to benefit financially, exchange services or evade law enforcement. Nagin and Smith (1990) analyzed the first two waves of the National Youth Survey and found exposure to delinquent peers had a positive effect on the frequency of delinquency. This relationship is also present in this sample. Participants who are embedded in large youth networks are more likely to be involved with multiple sites (r=.21, p<.01). More importantly however, past research suggests that the more crime an offender commits, the greater the criminal income (Tremblay & Morselli, 2000; Morselli & Tremblay 2004; Morselli et al., 2006). Similarly, Reuter et al. (1990) found that drug selling income increased as a function of frequency of selling. Thus, it is not surprising that respondents who are involved with multiple sites report more earnings from cultivation.

Recall that Warr (1996; 2002) differentiated offending groups and networks by stating that offending groups are groups that actually commit crimes together but accomplice networks are the pool of potential co-offenders available to the offender. This thesis is also interested in this distinction as it relates to criminal achievement. Size of co-offending group has been shown to affect criminal earnings. For example, Fagan (1991) and Reuter et al. (1990) found that drug dealers who worked in groups earned more than solo dealers. At the bivariate level, number of co-offenders is positively related to illegal earnings. This relationship however is lost at the multivariate level, most likely due to the relationship between size of co-offending group and commercial sites

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(r=.31, p<.01), which suggests that size of co-offending group may be an indicator of mere organizational size. This finding is interesting because it highlights the importance of networks over immediate co-offending group on instrumental returns in cannabis cultivation. For cannabis cultivation, earnings may be more dependent on people who are not directly related to the cultivation site. For example, mentors and customers are not necessarily present during cultivation but are nonetheless key contacts who contribute to criminal earnings. Therefore Tremblay's (1993) definition of co-offenders, "all those other offenders he must rely on before, during, and after the crime event in order to make the contemplated crime possible or worthwhile", is perhaps most appropriate for cannabis cultivation (p.20).

In addition to large youth networks and size of co-offending group, working on commercial sites is the strongest predictor for earning money from cannabis cultivation. All the respondents who earn more than $5000 work in commercial sites. This finding is hardly surprising. Larger cannabis production sites are associated with reselling cannabis rather than personal consumption or supplying to a small group of friends. Furthermore, 76.7% of respondents who work on commercial sites report "making money" as a motivator for participating in cannabis cultivation. This motivator is consistent with the entrepreneurial commercial growers described in past studies on cannabis growers (Weisheit, 1992; Potter, 2006; Hough et al., 2003).

One finding that has been consistent in criminal achievement literature is that drug use is a significant positive predictor of illegal earnings (Uggen & Thompson, 2003; Morselli & Tremblay, 2004; Fagan, 1994). It was expected that regular hard drug use would increase illegal earnings; however this is not the case. Bivariate analysis reveals that there is no significant relationship between regular hard drug use and earnings from cannabis cultivation. There could be two possible reasons for this non significant finding. First, the positive relationship between drug use and criminal earnings found in past

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literature is often mediated by frequency of offending due to the need to generate quick cash (Uggen & Thompson, 2003). Cannabis cultivation is perhaps not the best endeavor to provide quick cash as it requires a minimum of three months to reap the potential benefits and also involves differential levels of strategic planning. While not available in the present data set, the relationship between drug use and drug dealing income may produce more fruitful results. Second, past studies analyzed adult samples whereas this study explores a sample of high school adolescents. As such, only a fifth of the sample admitted to using hard drugs at least once a week. When this variable is teased out further, only 6.3% used cocaine/crack and fewer (4.6%) used heroin at least once a week, drugs that are known to be highly addictive and expensive and associated with "economic compulsive crimes", which are crimes committed in order to support one's drug habit (see Goldstein, 1985).

In short, consistent with social capital theory, respondents embedded in large youth networks have better opportunities than respondents who are not a part of a large network of youth. As a result of having better opportunities, these adolescents earn more money than others who do not have the same network. While a number of factors are important to earnings, such as opportunities and organizational size, it is important to highlight that networks show a significant and independent effect on instrumental returns. This assertion is underscored by the CHAID analysis. CHAID analysis reveals that embeddedness large youth networks and gang membership are key to making substantial earnings (more than $5000) from cannabis cultivation. Conversely, adolescents who do not have a large youth network, especially if they're female are the least likely to have substantial earnings.

5.2 Expressive returns

Recognizing that the cultivation industry provides an opportunity for contact between adolescents and adult growers, network composition and its impact on cost avoidance is an interest of this study. According to many social capital researchers, homophilious ties generally promote trust and reciprocity and hence increase solidarity among its members, in turn increasing expressive returns (e.g. Coleman, 1990; Lin, 2005). Heterophily in networks can serve to weaken the bonds and shared interests and thus reduce solidarity and cohesion. The literature regarding network or co-offending composition on expressive returns suggest that when youth work with adults, they are often placed in risky low-level positions (Padilla, 1992; Desroches, 2005). Contrary to expectations, only one of 31 respondents embedded in adult networks was arrested as a result of his/her involvement in cannabis cultivation and only 3 were participated in a detected site. CHAID analysis reveals that for youth working in indoor sites, those embedded in youth networks double their chances of being arrested compared to youth embedded in adult or balanced networks (44 vs. 21%). Consequently, networks appear to both help and hinder cost avoidance; it all depends on the type of network a participant is embedded in.

One can consider several mechanisms that explain these results. The first is that many participants who are embedded in adult networks are hired helpers (37.5%). Most of the tasks for which growers are typically hired, with the exception of daily maintenance (which is unlikely for most youths), only requires between one and a few days of work: installing equipment, harvesting plants, trimming buds (Weisheit, 1992). Such sporadic or irregular involvement might not be enough for them to be linked to a particular site, if detected. The possibility that many of these adolescents actually help out their parents, on a cultivation site situated in their own home is also likely. Even in

the case of a seizure, these youths would not be held responsible for the site, and would avoid apprehension.

Second, recall that not all adolescents embedded in adult networks are mere helpers. In fact, 62.5% of respondents who are in adult networks are owners or co-owners of the cultivation site. Being surrounded by more experienced growers might increase young growers' criminal capital and accelerate their learning curve (Kleiman 1989; Caulkins, 2001). Offences like cannabis cultivation require a certain amount of learning before growers are considered comfortable, competent, or completely independent (Weisheit, 1992). The process involves trial and error, and young growers and novices in general are prone to mistakes. Some of these mistakes have more consequences than others, including some that lead to detection. Being involved in adult networks might help growers avoid some of these mistakes, and start them higher on the learning curve.

While extant literature clearly suggests that large networks are beneficial to instrumental returns, the research surrounding network size and expressive returns is contradictory. On one hand, a number of studies suggest that some offenders (especially ones in high positions) increase the size of their networks to insulate themselves from arrest (Baker & Faulkner, 1993; Dorn et al., 1998; Williams, 2001). On the other hand, in illegal markets, having the fewest individuals possible who know about ongoing illegal business activities is a main strategy used by offenders for avoiding detection (Adler, 1993; Desroches, 2005; Reuter, 1983; VanNostrand & Tewksbury, 1999). In addition to network type, size surfaces as important. Respondents in large youth networks are at greater odds of participating in a detected site than respondents who are not a part of a large youth network (34.5 vs 23.3%). However, the relationship between respondents in a large adult network and cost avoidance are not conclusive. Bivariate and multivariate results suggest a protective effect. One stage in the detection

model indicates a marginally significant (p<.10) protective effect of being embedded in a large adult network but fails to reach significance in any of the arrest models. Thus, it appears that respondents in large adult networks are neither protected nor earn more money than those who are not embedded in large adult networks.

One possible explanation for the heightened risks of detection for respondents embedded in large youth networks is that it may not be a product of their networks per se but likely the culmination of their risk behaviours and their increased visibility. On the whole, growers embedded in large youth networks engage in other crimes, sell drugs, and consume more cannabis than their adult embedded counterparts. These risk behaviours are not direct predictors of detection but have an impact when they go through the offender's network, suggesting that they are network specific. Although the entire sample is delinquent, this indicates that being associated with a large youth grower group enhances one's propensity to general delinquency, or vice versa (see Matsueda & Anderson, 1998). The combination of risk behaviours, groups of youth and heightened risk of attention from law enforcement is strikingly reminiscent of the group hazard hypothesis (Erickson, 1973; Feyerherm, 1980; Morash, 1984). According to Morash (1984) peer groups are deemed as more delinquent and perceived as a threat because they have increased visibility, thus they are more likely to be arrested. Despite this conjectured interplay, it is important to emphasize that being embedded in a large youth network is a significant risk factor of participating in detected site net of other risk factors in the model. This highlights the tradeoffs for adolescents embedded in large youth networks: while they earn more money, they are also at greater risks of participating in a detected site than adolescents who are not part of a large youth network.

Contrary to instrumental returns, it appears that for expressive returns, networks are more important than organizational size. Neither the number co-offenders nor

working in commercial sites are significant to cost avoidance. Generally in illegal drug markets, size connotes risk, so it was surprising that in this study, organizational size does not affect cost avoidance. This non finding may be indicative that the role that an adolescent assumes in the cultivation site and the social capital acquired from being close to more experienced growers may be more important to protecting from risk than the actual size of the site.

In addition to network characteristics, two other factors emerge as important to cost avoidance: location and drug dealing. Research suggests that outdoor cultivation sites are at greater risks of detection than indoor sites (Bouchard, 2007). Despite its higher detection rate, it is easier for outdoor growers to evade arrest but when detected, indoor sites result in greater likelihood of arrest (Bouchard, 2007). Unlike indoor sites, often located in private homes, outdoor growers can leave the plot unattended for extended periods of time, or only visit the plots at night (Bouchard, 2007; Wilkins & Casswell, 2003). Thus, compared to indoor sites, it is harder for law enforcement to link suspects to outdoor sites. This is also found here. Compared to participants who work in outdoor sites, participants involved in indoor sites are significantly more likely to be arrested (29.9% vs 8.3%). Similarly, this is the case for participating in a detected site (40.3% vs 18.5%). The finding for indoor sites and detection may be largely due to the operational definition of detection (if the participant was arrested themselves or knew someone from the same site who was arrested). It is expected that the figure for outdoor sites and detection may be larger if it includes sites where no one was arrested.

Finally, drug dealing is associated with its own risk issues. However, when cultivation is combined with selling drugs, it was expected that there could be a heightened probability of being arrested for cultivation. Despite reaching significance at the bivariate level, logistic regression surprisingly reveals that drug dealing is a protective factor for participating in a detected site. Drug dealers appear to be active in

cannabis cultivation, evidenced by factors like working in commercial sites (r=.24, p<.01), participation in multiple sites (r=.28, p<.01) and being embedded in large youth networks (r=.28, p<.01). As such, grower-dealers are also positively correlated to earning more money from cultivation (r=.25, p<01). So it was perplexing why selling hard drugs emerges as a protective factor. Further analyses reveal the answer: For grower-dealers who are embedded in adult networks (n=20), none of these respondents were arrested or participated in a detected site, suggesting that an offender's social environment can offer protection. This finding further illustrates the important direct and indirect roles that networks play in criminal achievement.

In sum, the factors associated with instrumental returns are different than for expressive returns. Being embedded in large youth networks provide social capital and opportunities to make money but a larger network of youth enhances the risks of detection. Embeddedness in large adult networks however, does not seem to have an effect on either earnings or cost avoidance: it is neither risky nor beneficial. Type of network is not as important for earnings as it is for cost avoidance. Participants embedded in adult networks are protected whereas respondents in youth networks are at greater odds of detection. In addition to network dynamics, size of cultivation site (number co-offenders and number of plants) and frequency of offending (multiple sites) positively influence the earnings. In terms of cost avoidance, context (type of site) plays an important role. These findings suggest that there is a delicate balance in being able to reap the monetary benefits of cannabis cultivation and avoiding cost.

5.3 Trade-offs

The focus of this thesis is not only to explore factors that are associated with instrumental and expressive actions, but also to look at the balance between the two. The tension between the two types of actions (instrumental vs expressive) and their

associated network characteristics have been recognized and discussed by many social

capital researchers (e.g. Adler & Kwon, 2002; Burt, 2005; Lin, 2005). Morselli and

colleagues (2007) examined the trade-offs between efficiency and security in criminal

and terrorist networks, recognizing that networks structures differ according to their

collective motives and objectives. Drug networks for example, are monetarily motivated

so their resources center towards efficiency over secrecy whereas terrorist networks

emphasize secrecy above all else. Several trade-offs are also found here and merit

attention because they shed light on the balance required to garner the full benefits of

social capital.

The first trade-off is related to experience as a grower. The more experience a

respondent has, the more money he/she earns but it also presents more time at risk for

detection. Participants who earn more than $5000 and more than $10,000 have on

average of 3.0 and 2.7 years experience respectively. This is considerably more when

compared to the rest of the sample (x=1.9 years). Respondents who were arrested have

an average of 2.3 years experience compared to 1.8 for those who were not arrested.

Social capital and criminal capital sheds light on why respondents who have

more experience earn more than adolescents with less experience. Recall that criminal

capital provides offenders with the skills and knowledge that aids in offending (McCarthy

& Hagan, 1995; 2001). A number of studies have linked criminal capital to criminal

success. Sullivan (1989) suggests that the more skilled a drug dealer is, the more

successful he/she will be in the criminal enterprise. Padilla (1992) documents the

process of youngsters who undergo training to become a street level dealer and notes

that drug dealing requires planning and time to develop specific skills. Yet, according to

Burt (1998) and Coleman (1992) human capital cannot be achieved without social

capital. Coleman (1988) asserts that even though human capital exists, a person does

not profit from it unless there is social capital present. Burt (1998) echoes this assertion

by arguing human capital is necessary to succeed, but is useless without social capital to gain the opportunities to employ it. Burt (1990) underlines on the relationship between the two by stating that social capital is the contextual complement to human capital. Experience however comes with a price: It provides more time to potentially be exposed to law enforcement. Years of experience is marginally (p<.10) related to arrest at the bivariate level but is not significant in the logistic regression models. This suggests that while more experience is related to greater odds of arrest, this relationship is cursory in comparison to other factors like the type of network a respondent is embedded in and the location of the site (indoor vs. outdoor).

The second trade-off is related to intensity of involvement. Being an owner is positively related to both making money and being arrested. The distinction between being an owner and labourer is an important one. Ownership of a cultivation site represents a more serious involvement than having been hired as a helper. Owning a cultivation site for profit represents a significant step further in terms of intensity of participation. The relationship between intensity of involvement and earnings is very clear and follows a linear pattern (r=.22, p<.01). Among individuals who make more than $10,000, 82.4% are owners or co-owners of the site. The relationship between intensity of involvement and cost avoidance is not as clear but there is indication that the relationship is also positive. Bivariate analysis reveals that compared to labourers, owners are more likely to be arrested (19.2 vs. 12.7%). The bivariate result is not statistically significant but being an owner emerges as a significant risk factor of arrest in the logistic regression models.

One reason that intensity of involvement may be positively linked to both criminal achievement dimensions is that it appears that owners are more connected than labourers. Notice that 37.5% of owners report knowing more than 15 other youths at their school and 26% report knowing more than 15 adults involved in cannabis

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cultivation. On one hand, this "hyper-connectedness" makes it possible for adolescents to own or co-own their own site since it requires considerable social capital to gather sufficient resources to start a cultivation site for themselves. On the other hand, it is perhaps the large number of contacts that increase their odds of arrest. Recall that being embedded in a large youth network is a significant risk factor.

The third trade-off is related to gender. Females in the sample are in an unfavourable situation: They earn relatively little from their participation in cultivation but interestingly, fare no better than the rest of the sample in terms of arrest and detection. A third of the females (27.1%) earn no money and only 3.4% report making more than $5000 from their cannabis related activities. Further analysis reveals that the only network variable that surfaces as significant between males and females is that more females are embedded in adult networks. It appears that being embedded in adult networks reduced the majority of female participation to the form of low level, fringe roles (66.1% are labourers). The adults in their networks do not provide them with greater protection from arrest nor did they earn any substantial amounts of money for participation.

It is possible that their gender prevents females from accessing the social capital afforded to their male counterparts. Burt's (1998) analysis of gender and social capital suggests that women are often "illegitimate" members in male dominated entrepreneurial networks and do not have equal access to social capital. Lin (2000) discussed inequality in returns from social capital between males and females and concluded that given the same quantity and quality of social capital, males will generate greater rewards in the form of prestige and earnings from their social capital than their female counterparts. Morselli and Tremblay (2000) also found that male offenders were more likely to benefit from monetary opportunities than their female counterparts. Not only does it appear that females may lack access to social capital that males do, there is indication that females

structure their networks differently and enjoy smaller networks with homophilious ties (Lin, 2000). The sample in this study is restricted to adolescent females and questions remain whether the results would be consistent with an adult sample. Criminal achievement literature has yet to explore the differences between the genders and this would be an interesting avenue of research to pursue.

The prevalence of females in the sample is a result that is interesting in itself: A third of the sample (33%) are girls. However, arrest data shows that the majority of cannabis growers are male. Plecas et al. (2002) found that the 23% of suspected growers are female while other studies have placed this figure to be around 15% (Bouchard, 2007; Potter, 2006; Corkery, 2002). Some research indicates that women are playing an increasingly important role in the drug trade. In her study of females in the illicit drug economy Denton (2001) notes that entry into the drug trade was due to her social networks where the line between licit and illicit work was blurred and many were able to work their way up to higher roles. Hafley and Tewksbury (1996) also observed that more women are being recruited and trained by males and are playing a more egalitarian role in cannabis cultivation. Other research however, suggests that idea of the glass ceiling, where women are confined to low-level roles is also prevalent in illegal drug markets (Maher & Hudson, 2007). Fagan (1994) studied 311 women in the drug industry from two northern Manhattan neighborhoods and found that relatively few women occupied important roles and were relegated to positions like runners and lookouts. This appears to be consistent with the females in the present sample.

The last trade-off is related to gang membership. Gang members are the most successful respondents in the sample. Being a gang member appears to help with both earnings and cost avoidance. A third of the gang members reported making more than $5000 (3 made more than $5000 and 8 made more than $10,000) from the last time they participated in cultivation and only 5 were arrested themselves. Gangs present a more

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complex structure than youth groups in that gangs are based on solidarity and cohesion, which is often supported through criminal activity (Thornberry et al., 1993; Venkatesh, 1997). Gang culture is often characteristic of loyalty and the furthering of the gang's profits (Skolnick et al., 1990). Oheme (1997) suggests that many youth gangs that engage in the drug trade have affiliations with adult organizations that can facilitate the acquisition of drugs. In his network analysis of three gangs associated with a larger drug trafficking network in Montreal, Morselli (2008) found that most gangs are loosely structured and only the higher level gang members had direct links to the core of the trafficking network. Here, it is not unlikely that affiliations with adults aid in establishing gang members as the "entrepreneurs" of the sample. Additional analyses show that 37.9% of gang members work on large commercial sites (500 or more plants) and 33.3% sell quantities of one pound or more. This dynamic is strikingly reminiscent of Burt's "structurally autonomous" groups. Recall that these groups consist of individuals who are strongly connected to one another but have "bridge relations beyond the group", thereby achieving the trust and safety of closure and the opportunities of brokerage (Burt, 2005, p.140-141). The solidarity and loyalty that accrues within gangs establish the dense network required for maintaining the safety of its members and some of the connections (perhaps heterophilious ties to adults) that some members of the gang may have provide the opportunities for earning more money. While some social capital researchers recognize that gangs constitute a form of social capital, albeit a negative form, most recognize them as a resource for expressive goals of solidarity and cohesion (e.g. Putnam, 1995; Portes, 1998). Future research should explore gang structure as a mechanism for both expressive and instrumental utility. Ties between youth gangs and adult affiliations are also a dynamic of particular importance to consider in future research.

The trade-offs between instrumental and expressive returns are delicate. The CHAID analysis (Figure 4) illustrates gang members who work in commercial sites are able to strike a balance between earning more than $5000 while still being able to avoiding arrest. Alternatively, females who work on commercial sites but are not gang members are the least to thrive: they earn very little but still face the same risks as the rest of the sample.

6: CONCLUSION

The results of this thesis supports Lin's notion that the social relations that facilitate instrumental needs, such as making money, may differ from the relations that facilitate preserving expressive needs, such as one's freedom. Results suggest that when it comes to instrumental returns, networks help. Knowing a large number of other youth who also participate in cultivation helps with making money, which is most likely due to the additional opportunities that these connections provide. For expressive returns, networks can both hinder and help depending on the type of network a respondent is embedded. Adult networks appear to provide a protective effect whereas youth networks seem to be risky. Another important finding is that gang members are the most successful of the sample: They earn the most money while avoiding arrest thus supporting Burt's assertion that there is an optimal network structure that benefits from both forms of social capital. This chapter concludes this thesis by addressing some of the limitations of the study and discussing some implications and avenues for future research.

6.1 Limitations

This thesis has several limitations that should be taken into account when interpreting the findings. First, the sample size is smaller than preferable for the kind of analyses constructed here and the main variables of interest. This issue is addressed by using two multivariate methods to test each dependent variable. This not only confirms the iterative strategy of selecting variables for the regression analyses but illustrates valuable profiles and interactions that traditional regression analyses does not easily

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provide. Nevertheless, it would be good if future research can conduct similar analyses

using larger samples. Past studies on cannabis growers have used considerably modest

samples as growers are generally a hard to reach population. For example, Hafley and

Tewksbury (1996) interviewed 55 adult growers in Kentucky and Weisheit (1992)

interviewed 31 commercial growers in rural Illinois. Recently however, with the

availability of web surveys, some researchers are now using this technique to reach

cannabis growers. For example, Decorte and Tuteleers (2007) surveyed 659 cannabis

growers in Belgium on the web using clever publicity strategies. Like with most methods,

web surveys offer a range of advantages and disadvantages, but using the internet to

complement high school self-report surveys, such as the one used here, would be both

interesting and cost efficient.

Second, it was conjectured that mentorship is one of the mechanisms why

adolescents who are embedded in adult networks have a lesser risk of arrest. The data

however, does not indicate specifically if respondents are mentored, or if they are aware

of such mentors in their networks. The data also does not indicate whether mentors, if

present, are direct co-offenders or if they are just part of the participants' larger network.

The data only identifies if growers are embedded in predominately adult or

predominately youth networks. Given this, it can be inferred that the impact of knowing

experienced growers might offer tutelage and mentorship to these young offenders. This

finding might be interesting enough to induce future research to incorporate more

detailed questions on the nature of such relationships. Future studies should also

consider that the relationship between mentors and apprentices may not be limited to

adult-youth relationships, but also consider experiential differences and gender

dynamics.

Third, the data facilitates the assessment of the size and composition of an

offender's network and purposes of action (instrumental and expressive action).

However it does not permit the consideration of other important network features. Recall that Lin (2001) points to other factors such as network closure or openness, strength of ties and structural holes as important factors for examining social capital. Recent studies on youth networks have also examined the influence of peers on offending behaviour (Haynie, 2001; Haynie, 2002; Payne and Cornwell, 2007) and found that network structure matters. For example, using data from a representative sample of 13,000 adolescents in the United States, Haynie (2001) found a stronger association between peers and delinquency for adolescents who are located in a central position within their friendship network. It would be a value avenue of research to design studies that would enable the analysis of all these features together. Another interesting research design would be to complement name generating methodologies, which has been used in past criminological research (e.g. Morselli & Tremblay 2004, Haynie, 2001) with position generating methodologies. Name generating methodologies produce a list of individuals in an ego's network whereas position generating methodologies examine an ego's access to structural positions within a hierarchy. It therefore allows researchers to examine an ego's vertical reach through his/her social ties (Lin, 2005). This would be a useful analytical tool when examining the role of social capital and criminal achievement in organizational structures, like gangs.

Last, one should be careful in generalizing the findings of this study to other populations. As mentioned earlier, the location was chosen for its high prevalence of youth participation in the cultivation industry. It is unclear if similar patterns would be found in other samples where cannabis cultivation is not as prevalent. Similar studies should be undertaken in order to verify if the general patterns that are found here hold for different contexts, for different samples, and for different types of crime. As far as context, it would be extremely interesting to replicate the study in a similar rural region in British Columbia, which also has high prevalence of cannabis cultivation. In addition,

replication in urban areas known for indoor cultivation may produce different results. It is expected that the network characteristics that are beneficial in cannabis cultivation, may not be the same for other types of crimes. Recall that cannabis cultivation presents a unique environment for network dynamics, co-offending and opportunities for youth participation.

Despite these limitations, this study contributes to the criminal achievement literature by showing that criminal networks play an important role in early criminal career success. It also illustrates that there are considerable trade-offs when both instrumental and expressive returns are to be achieved. The next section looks at some of the implications of these findings.

6.2 Policy implications

This thesis, like a small number of previous efforts (e.g. Kleiman, 1997), wishes to bring the policy debate on the supply side of the cannabis industry. One thing is apparent when looking at this sample; youth who participate in cannabis cultivation are a heterogeneous group. This thesis started with guidance from criminal achievement literature and interprets many of its findings within the criminal career perspective. It is therefore reasonable to look at the implications of this study through the criminal career perspective when considering preventing further involvement in cannabis cultivation.

The first step is to consider how youth get involved in cultivation in the first place. This study takes place in a region where cultivation is pervasive. Some of the respondents appear to participate in this industry in minor roles and perhaps this is a consequence of the cheap available labour associated with youth. In other drug markets, adolescents have been used as available inexpensive labor to help water and harvest on poppy farms (Westermeyer, 2004), and as runners, lookouts or for packaging drugs (Lepiten, 2002). For these youth, how would we prevent their entry into the industry?

Given the focus of the current study, one plausible place to begin is by returning to social capital literature. Coleman (1998) suggests that communities with strong conventional social norms can aid in preventing adolescents from entering into deviancy. Coleman (1994) suggests despite taking a large portion of the market share for consumer goods, youth are increasingly marginalized in the employment world. One way to promote youth to enter the workforce is by increasing human capital through social capital. Social capital created by strong ties to family and school should be increased by furthering students' interests in school instead of competing interests in deviant extracurricular activities, like cannabis cultivation. Developing conventional human capital can be an approach in preventing the acquisition of criminal capital.

This approach may be valuable for youth who are enticed by entering the industry to make a little extra money, but what a hbout the youth who participate in cultivation because it *is* the norm for them? Hafley and Tewksbury (1996) recognized that many growers enter the ubiquitous rural Kentucky cannabis industry because of their kinship ties. One interesting avenue for future research is to look at youth progression throughout their criminal career and indentify adolescents who are embedded in networks of relatives and assess if they have a different trajectory than youth who have to acquire the social and criminal capital for themselves.

A second valuable way of viewing youth involvement in cannabis cultivation is to ask whether their involvement affects the wider drug market or is contained among their peers. Much of the supply of cannabis (and to some extent some other softer drugs like ecstasy) are restricted within adolescents' social circles. There is a substantive difference between youth who participate in their own markets compared to youth who participate in the wider drug markets as we know them (Coomber & Turnbull, 2007). Many of the personal use growers clearly to fall within this domain: They grow in small

quantities to supply their own cannabis use and/or perhaps supply to a small group of friends. They have little involvement in criminal activities and other drug use. As such, the criminal justice response should recognize the distinction between these types of young growers whose actions are merely manifestations of socialized norms of their age group and of the region where they live and not indicative of a deeper involvement in a lifestyle of criminality.

A third consideration is that while some youths participate in relatively minor roles, other juveniles are more serious in their involvement and are more successful at it. Criminal achievement research finds that success tends to breed future success: Individuals who have higher criminal earnings have also been associated with higher rates of re-offending and longer criminal careers (Robitaille, 2004; Matsueda et al., 1992; Shover & Thompson, 1992; Piliavin et al., 1986). For example, in assessing serious criminal offenders, drug addicts, and adolescent school dropouts, Matsueda and colleagues (1992) found that previous illegal earnings and prior arrests are linked to positive effects on subsequent illegal activity and earnings from that activity. Moreover, the researchers found that prior illegal earnings and an offender's perceived prestige was positively associated. Using data collected by the RAND Corporation on inmates in Texas, Michigan and California, Shover and Thompson (1992) discovered that the ability to avoid prison was a negative predictor of desistance and suggest that the decision to cease offending is inversely related to expectations for success in crime. That is, the more an offender expects to be successful the less likely he/she will desist from crime. Chaiken and Chaiken (1985) discovered a small subgroup of "successful" offenders in the same sample who, despite their high rate of offending, were able to escape arrest for a very long time. Because they used an incarcerated sample, these successful offenders were eventually caught but the authors suggest that this finding points to the existence

of a subset of criminals who are enjoying successful criminal careers yet fly under the law enforcement radar.

In the current study, 12% (n=21) appear to be following this trajectory. It is remarkable that there is subsample of successful offenders among a sample of adolescents,. Past research has pinpointed offenders who achieve greater earnings (Morselli & Tremblay, 2004; Uggen & Thompson, 2003) and who are able to avoid arrest (Kazemian & Leblanc, 2007), but rarely offenders who manage to achieve both dimensions of criminal achievement, especially among a sample of youth. The question is now whether early success leads to persistent involvement, even as they transition into adulthood? Unfortunately, this thesis cannot provide much in terms of answers to this question but studies using longitudinal designs can and hopefully these studies can integrate measures that are related to criminal achievement.

Lastly, one important factor associated with being successful is gang membership. The current sample consists of 30 self-reported gang members. This 17.8% prevalence rate is expectedly high because it is among a sample of already "delinquent" youth who participate in cultivation. Wortley and Tanner (2004) sampled 3, 393 high school students in Toronto, Canada and found that 5.7% were self-reported gang members, which is comparable to the 3.9% prevalence rate when the entire sample is of the high school students (n=1166) surveyed here is taken into account. However, Wortley and Tanner's sample consists of high school students in the Toronto metropolitan area. The bulk of gang research focuses on urban youth gangs because urban areas are more likely to have higher degrees of gang membership than rural areas (e.g Chettleburgh, 2007; Maxson et al., 1996). However, gang migration from cities to communities has been a recent phenomenon largely due to the expansion of the drug trade (Maxson et al., 1996; Skolnick et al., 1990). This expansion is likely into communities "where drug dealing profits may be substantially greater and the risk of

apprehension considerably lower" (Oheme, 1997, p.147). This phenomenon has also been witnessed in the rural Kentucky marijuana industry (Hafley & Tewksbury, 1998). Maxson (1998) documents that gangs now exist in areas that previously were not affected and are increasingly attracting a larger proportion of youth. Gangs should be an important focus not only because their involvement in the region's cannabis industry but also because a significant proportion of gang members excel at it. One third of the gang members are "successful" as it is operationally defined. The importance of gang members in recruiting and mentoring neophytes should not be overlooked. Young offenders are especially likely to learn and be influenced by older offenders. Bayer et al.'s (2008) analysis of recidivism among a sample of over 8,000 incarcerated juvenile offenders showed that exposure to older peers exerts more influence on young offenders' behavior upon release than exposure to peers similar in age. This was especially the case for burglary, robbery, and drug offences.

The heterogeneity of youth involved in cannabis cultivation is a dynamic that law enforcement should consider. If the focus of law enforcement is eradication of cannabis cultivation, many youth who are otherwise "good kids" could suffer the greatest consequences while gang members who earn the most can successfully evade arrest. One strategy may be to mobilize and enhance law enforcement and community resources aimed at gang prevention, something that rural communities may not recognize as a concern.

This thesis demonstrates the importance of social relationships in shaping the success of young offenders. However, given the same social capital, two offenders may choose to access and mobilize their resources differently (Lin, 2001). Therefore, in addition to social capital, individual differences, such as criminal capital (McCarthy & Hagan, 2001), decision making (Viscusi, 1986; Piliavin et al., 1986) and personality characteristics like self-control (Morselli & Tremblay, 2004) are also essential in

understanding criminal achievement. This research suggests that young offenders

present an interesting and important population to explore for criminal achievement

research because it appears that criminal success can be achieved very early.

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APPENDIX A: TABLES

Table 8 Correlation matrix of all variables (Spearman's rho)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Gender (f=1)	1.000																				
2. Age	.056	1.000																			
3. Other crime	.015	.025	1.000																		
4. Dealer	-.185*	-.144	.305**	1.000																	
5. Hard drug use	-.014	-.065	.139	.199**	1.000																
6. Cannabis use	-.140	-.014	.243**	.525**	.250**	1.000															
7. Indoor site	.035	.040	.002	-.087	.089	-.007	1.000														
8. Owner	-.371**	.004	.027	.133	-.006	.013	-.211**	1.000													
9. Commercial	-.018	.050	.064	.237**	.205**	.050	.133	-.005	1.000												
10. Yrs exp	.016	.158*	.084	.091	.050	.003	.152*	-.028	.158*	1.000											
11. Multiple sites	-.153*	-.101	.097	.281**	.066	.155*	-.047	.113	.310**	.073	1.000										
12. Gang	-.087	-.030	.176*	.116	.179*	.171*	.236**	.150*	.125	.270**	.183*	1.000									
13. Predom adu	.132	-.081	-.093	.027	-.045	-.009	-.099	.030	.035	-.025	-.054	-.071	1.000								
14. Predom youth	-.105	.007	.130	.076	-.017	.073	-.088	-.084	.091	.045	.053	-.081	-.410**	1.000							
15. Balanced	-.014	.118	.022	-.065	.041	-.036	.150*	.033	-.134	-.060	.063	.157*	-.320**	-.586**	1.000						
16. Lrg adu	.005	.068	.022	.145	.001	.152*	.036	.072	.024	.013	.136	.087	.122	-.452**	.381**	1.000					
17. Lrg youth	-.066	.110	.270**	.279**	.134	.263**	-.001	.158*	.116	.128	.211**	.221**	-.320**	.060	.231**	.468**	1.000				
18. Cooffenders	.139	-.053	.179*	.182*	.085	.116	.076	-.101	.312**	.133	.203**	.165*	.050	-.094	.095	.196**	.221**	1.000			

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
19. Earnings	-.152*	.073	.035	.251**	.021	.069	.030	.221**	.489**	.200**	.336**	.175*	.014	.099	-.083	.053	.253**	.145	1.000		
20. Arrested	.007	.043	-.044	.044	.014	.106	.281**	.087	.029	.107	-.044	-.012	-.171*	.111	-.037	-.065	.062	-.017	.046	1.000	
21. Detected	-.023	.022	-.015	-.094	.028	.056	.239**	.002	.061	.152*	.006	.114	-.187*	.074	.006	-.061	.117	.036	.051	.735**	1.000

†p≤ .10 *p≤ .05 **p≤ .01 ***p≤ .001

Table 9 Bivariate results comparing arrested and detected but not arrested

	% Arrested	% Detected not arrested	Fisher's exact (p)
	16.6% (N=29)	10.3% (N=18)	
Demographics:			
Gender (female=1)	34.5	27.8	.75
Age (mean)	15.8	15.7	.68
Risk behaviours:			
Other crimes	51.7	61.1	.56
Drug dealing (last year)	55.2	22.2	.04*
Regular hard drug use	20.7	22.2	1.00
Regular cannabis use	69.0	50.0	.23
Type of site (indoor =1)	69.0	38.9	.07†
Intensity of involvement (Owner = 1)	69.0	44.4	.13
Commercial site	62.1	66.7	1.00
Multiple sites (2+)	41.4	55.6	.38
Years of exp growing (mean)	2.3	2.2	.64
Network variables:			
Gang member	17.2	38.9	.17
Predominantly adult network	3.4	11.1	.55
Predominantly youth network	55.2	38.9	.37
Balanced network	27.6	38.9	.52
Large adult grower network	17.2	22.2	.72
Large youth grower network	37.9	44.4	.76
Number of co-offenders (median)	3-4	3-4	.60
Earnings (median)	1-500	1-500	.97

†p≤ .10 *p≤ .05 **p≤ .01 ***p≤ .001

APPENDIX B: QUESTIONS USED FOR ANALYSES

Dependent variables (earnings, arrest and detection)

How much money did you make from your implication in the site (after subtracting what you invested)?

1. $0
2. Between $1-100
3. Between $101-500
4. Between $501-1000
5. Between $1001-5000
6. Between $5001-10,000
7. More than $10,000

As of today, how many times have you been arrested by police for your involvement in a cannabis cultivation site?

1. 1 time
2. 2 times
3. 3 times or more
4. I have never been arrested for my involvement in a cannabis cultivation site, but other participants at a site that I have participated in have been arrested
5. I have never been arrested for my involvement in cannabis cultivation

Main independent variables (co-offenders, network size, network type, gang membership)

How many people participated (including yourself), according to you, in the cultivation site (including cutting/trimming the plants)?

1. Just myself
2. 2 people
3. 3-4 people
4. 5-6 people
5. 7-9 people

Among all the adolescents you personally know at your school (friends and acquaintances), how many participated in at least one cannabis cultivation site in the last year?

1. None
2. 1 person
3. 2-3 people
4. 4-5 people
5. 6-9 people
6. 10-15 people
7. More than 15 people
8. I do not know

Among all the adults (18 years and older) you personally know (family, friends and acquaintances), how many participated in at least one cannabis cultivation site in the last year?

1. None
2. 1 person
3. 2-3 people
4. 4-5 people
5. 6-9 people
6. 10-15 people
7. More than 15 people
8. I do not know

In the past 12 months, have you been a part of an organized gang?

1. Yes
2. No
3. I do not want to respond

Control variables (gender, age, drug use, type of site, intensity of involvement (role), commercial sites, years experience, multiple sites)

Who are you?

1. A boy
2. A girl

How old are you?

1. 12 years or younger
2. 13 years
3. 14 years
4. 15 years
5. 16 years
6. 17 years
7. 18 years and older

How old were you when you participated in cannabis cultivation for the first time?

1. I never participated in a cannabis cultivation site (the questionnaire is finished for you)
2. 11 years or younger
3. 12 years
4. 13 years
5. 14 years
6. 15 years
7. 16 years
8. 17 years
9. 18 years and older

In the last 12 months, what is the frequency of your usage of the substances below?
Respond with (for each):

1. Have never used
2. Just once
3. Around 1 time per month
4. During the weekend or 1-2 times a week
5. 3 times or more a week but not everyday
6. Everyday

A. Cannabis (marijuana, hashish)
B. Cocaine (coke, snow, crack, free base)
C. Glue or solvents
D. Hallucinogens (LSD, PCP, mushrooms, acid, mescaline, ecstasy etc.)
E. Heroin (smack)
F. Amphetamines (speed, uppers)
G. Other drugs or medication without prescription (Valium, Librium, Dalmane, Halcion, Ativan, Ritalin etc.)

In the last 12 months, have you sold drugs?

1. Yes
2. No
3. I do not want to respond

If yes, what type of drug?
Respond with (for each):

A. Marijuana/hashish
B. Cocaine/crack
C. Heroin
D. Ecstasy, amphetamines or crystal methamphetamines
E. Hallucinogens (LSD, mescaline, PCP, blotting paper, magic mushrooms)

Have you ever committed a criminal act?

1. No
2. Yes
3. I do not want to respond

Type or types?
Respond with (for each):

1. Yes
2. No

A. Mischief (e.g. vandalism, disturbing the peace, break and enter)
B. Theft (e.g. handling stolen goods, theft without threat of violence)
C. Assault or battery (e.g. threat, physical
D. Drugs (e.g. possession or trafficking)
E. Fraud (e.g. stealing a credit card, use without permission)
F. Illegal firearms (e.g. possession or use of firearms without permit)
G. Sexual offences (e.g. prostitution, pimping, rape)
H. Breach of conditions (e.g. breach of probation)
I. Other crimes

If you participated in at least one site in the last 12 months, what type of site?

1. Indoor organic only
2. Indoor hydroponic only
3. Indoor other methods only
4. Outdoor only
5. Indoor and outdoor
6. I don't know

Which statement describes best describes the role than you have in the site?

1. I was employed by someone else
2. I was the sole owner of the site
3. I was the owner with one or more others
4. I never participated in a cannabis cultivation site

How many plants were harvested at the end of the production?

1. None
2. 1-20 plants
3. 21-50 plants
4. 51-100 plants
5. 101-200 plants
6. 201-500 plants
7. More than 500 plants

How many different cannabis cultivation sites have you participated in the last 12 months?

1. None
2. 1 site
3. 2 sites
4. 3-4 sites
5. 5-6 sites
6. 7-10 sites
7. More than 10 sites

**Questions translated from French to English by Martin Bouchard and Holly Nguyen